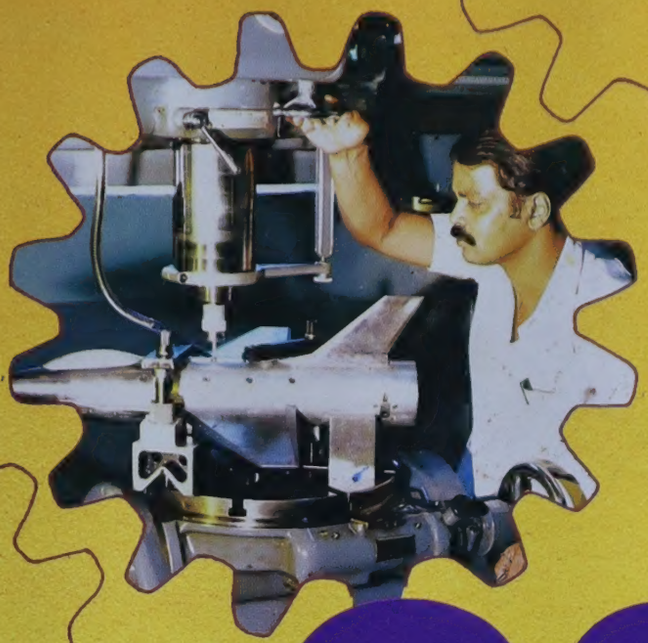
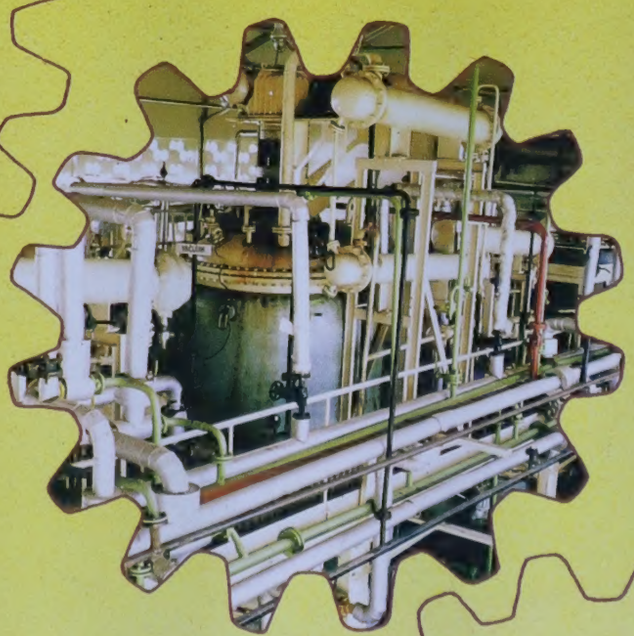


CSIR HANDBOOK



CSIR
Handbook

सी.एफ.टी.आर.आई. क्षेत्रीय केन्द्र
C.F.T.R.I. REGIONAL CENTRE,
679
डायरी नं./DIARY NO.
दिनांक/Date 21/2/94
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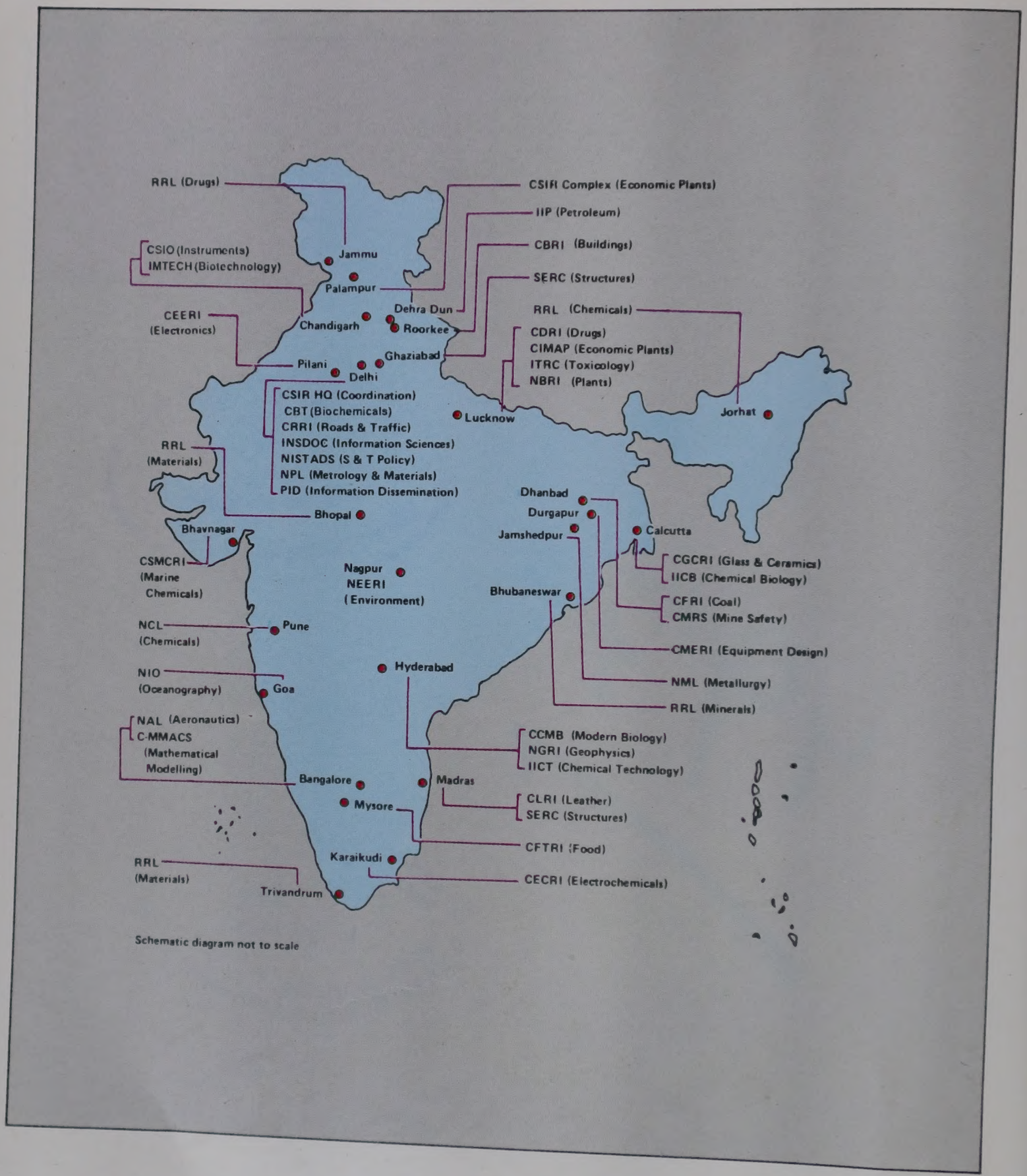
C.F.T.R.I. REGIONAL CENTRE LUDHIANA

CSIR NETWORK



CSIR
Handbook

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH
NEW DELHI 110 001

1993

Compiled and edited by:

Dr B.C. Sharma
Dr B.C. Kashyap
Madhu Sahni

Designed & Printed at the Publications & Information Directorate (PID)
Dr K.S. Krishnan Marg, New Delhi 110 012

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

PRESIDENT	Shri P.V. Narasimha Rao Prime Minister
VICE PRESIDENT	Shri P.R. Kumaramangalam Minister of State for Science & Technology
DIRECTOR GENERAL	Dr S.K. Joshi Secretary Department of Scientific and Industrial Research

Foreword

Council of Scientific and Industrial Research (CSIR), an autonomous body, was constituted in 1942 by a resolution of the then Central Legislative Assembly. The functions assigned to CSIR were:

- Promotion, guidance and coordination of scientific and industrial research in India
- Establishment or development of institutions and assistance to departments of existing institutions for specific study of problems affecting particular industries and trades
- Establishment and award of research studentships and fellowships
- Utilization of the results of the researches conducted under the auspices of the Council for the development of industries in the country
- Establishment, maintenance and management of laboratories, workshops, institutes and organizations to further scientific and industrial research
- Collection and dissemination of information in regard not only to research but also to industrial matters generally
- Publication of scientific papers and journals

CSIR has been continually striving to achieve these objectives leading to generation of new knowledge and new products, processes and technologies in diverse areas ranging from chemicals and drugs to materials and electronics; from safe drinking water and food technology to aerospace; and from environment protection and toxicology to petroleum processing. In the process, CSIR has grown to span a very wide S&T base. It has also emerged as a truly national organization with its 40 laboratories spread over the length and breadth of the country — from Kashmir to Kerala and Rajasthan to Assam. More than 25000 persons work in various laboratories and institutions of CSIR.

The focus of CSIR efforts has always been the development of indigenous technologies and optimum utilization of indigenous resources. In these efforts, interaction with users of CSIR technologies, i.e., industrial establishments is of vital importance. The first step in this interaction is making available to users adequate information about the infrastructure and R & D capabilities available in different CSIR laboratories. This information has been put together in a consolidated form in the CSIR Handbook. CSIR laboratories today want to actively participate in the industrial growth of our country. CSIR is trying to become a major player in enhancing country's industrial growth and quality of life of its people.

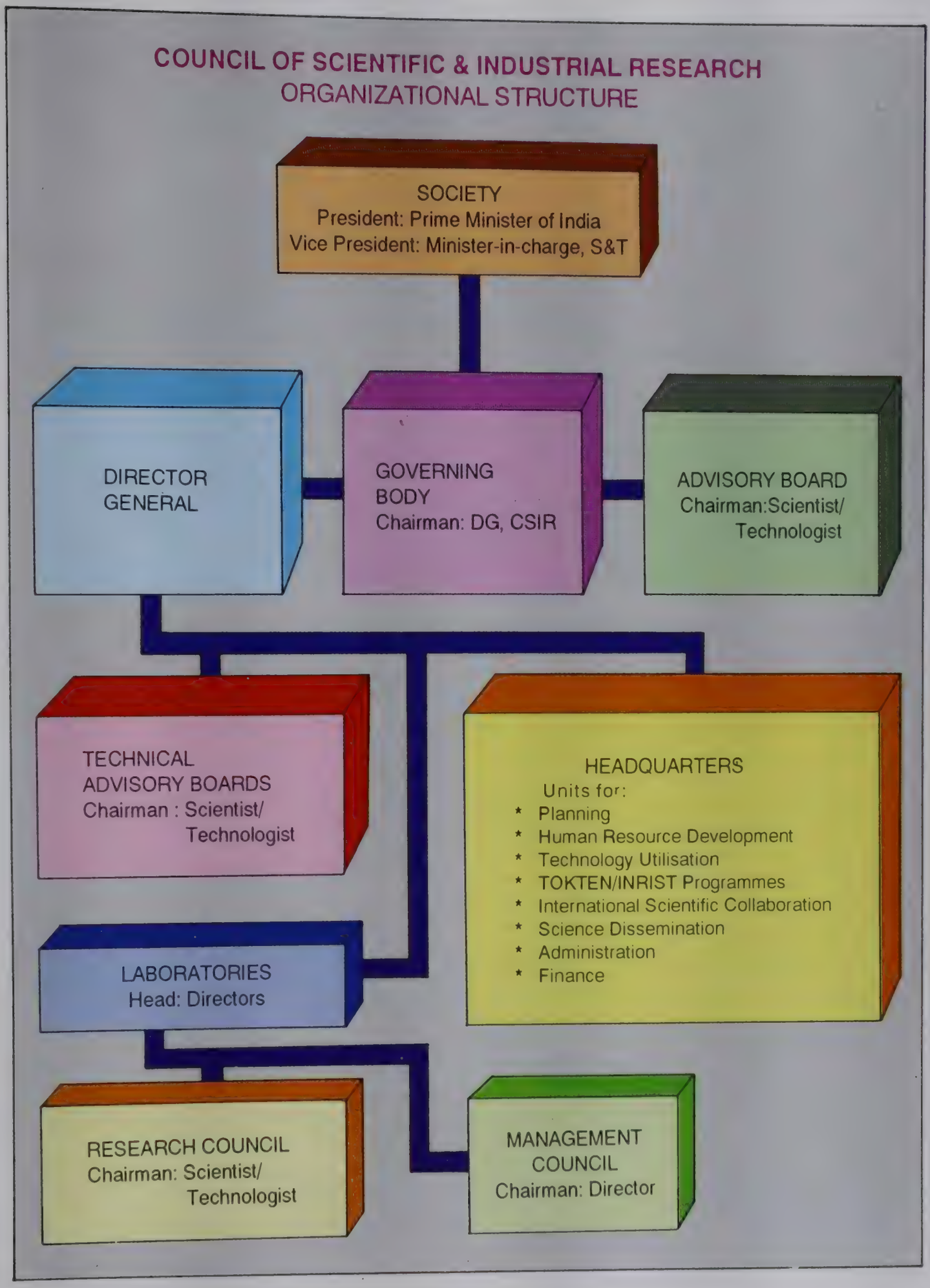
While the earlier editions of the CSIR Handbook were useful in their own ways, the new situation being faced by the laboratories under the changed economic scenario in the country demands that the R & D capabilities of the laboratories in different areas be reflected in a more direct and forthright manner. Therefore, the format of the CSIR Handbook has been changed to meet the desired objectives. The new edition focuses explicitly on the significant achievements, technologies transferred to industry/available for transfer, major facilities and services available in a user- friendly manner. The textual information has been supplemented by visual aids in the form of charts and photographs. I hope the new edition will prove to be helpful to users and promote the utilization of CSIR knowledgebase, technologies and infrastructural facilities.

We welcome suggestions from you to improve this Handbook in its future editions.

S.K. Joshi

(Dr S.K. Joshi)
Director General
Council of Scientific & Industrial Research
New Delhi

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH
ORGANIZATIONAL STRUCTURE



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64	Institute of Microbial Technology, Chandigarh
66	National Aerospace Laboratories, Bangalore
70	National Botanical Research Institute, Lucknow
72	National Chemical Laboratory, Pune
76	National Environmental Engineering Research Institute, Nagpur
80	National Geophysical Research Institute, Hyderabad
82	National Institute of Oceanography, Goa
86	National Institute of Science, Technology and Development Studies, New Delhi
88	National Metallurgical Laboratory, Jamshedpur
92	National Physical Laboratory, New Delhi
96	Publications & Information Directorate, New Delhi
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121	Technology Utilization Division, New Delhi
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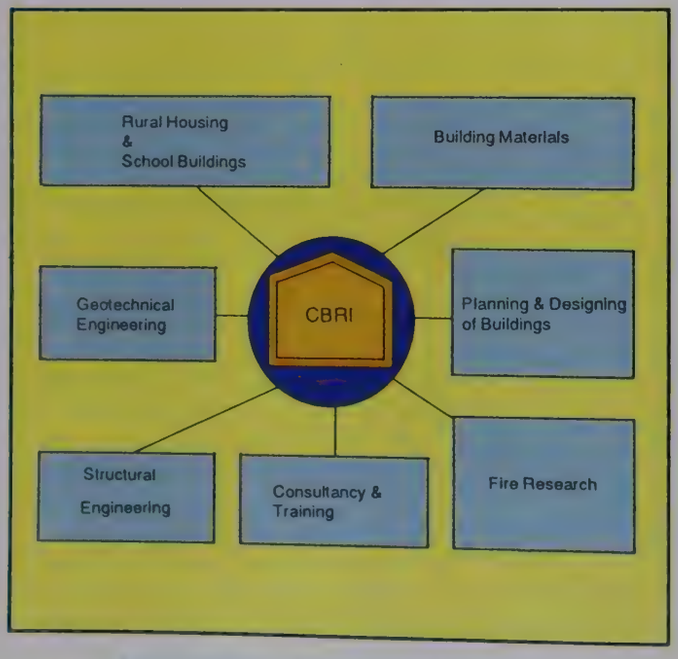
Central Building Research Institute (CBRI)

Roorkee 247 667
Telephone: 72243, 72269, 72293 Telegram: BILDSERCH ROORKEE
Telex: 0597 - 203 CBRI IN FAX: 01332-72272 E. Mail: cbri @ sirnetd. ernet. in

Established: 1951
Director: Dr T.S.R. Prasada Rao , Ph.D. (Chem.)
Budget for 1992-93: Rs 476 lakh

MANDATE

- To assist the building industry in solving problems relating to planning, foundations, materials, design and construction, functional efficiency, speed, economy and productivity in building construction
- To carry out R&D on fire hazards in buildings with a view to reducing loss of life and materials
- To disseminate information regarding results of research among potential users and to ensure, through appropriate measures,that they find expeditious and efficient application



MAJOR R&D PROGRAMMES

The major R&D programmes of CBRI relate to providing S & T back-up to the problems of buildings and construction industries in the areas of housing & planning, educational buildings, rural housing, building materials, geotechnical & structural engineering, building physics and fire research & testing. The institute also takes up developmental testing and provides technical aid to industry.

SIGNIFICANT ACHIEVEMENTS

- Formulation of space & land use standards, planning & design of economical buildings based on passive technologies & formulation of design briefs
- Design, development of space norms, planning guidelines for primary & secondary school buildings, and use of cost-saving construction materials and technologies; CBRI is the nodal agency for the construction of Navodaya Vidayalayas in different parts of the country
- Planning, design & construction of low-cost rural houses; use of locally available materials in the development of construction techniques for rural buildings; work has also been carried out on low-cost waste

Pile driving machine (7500 kg. cm and 10,000 kg. cm sizes)

disposal systems, water seal latrines, biogas plants for individuals & village communities

- Development of processes and technologies for the manufacture of improved building materials from natural resources; process technologies for utilization of mineral and industrial wastes; design & development of pollution-free brick and lime kilns

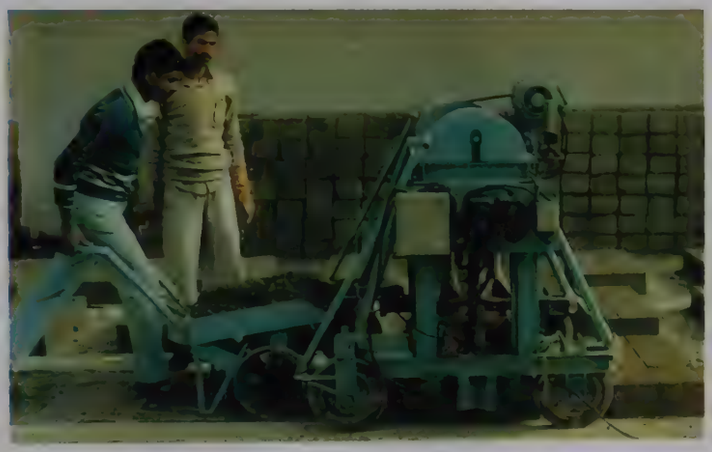
- Development of processes for products based on plastics and polymers, and technologies for utilization of agrowastes in the manufacture of building materials, anti-corrosive treatments for metals and concrete

- Development and design of economical foundations for buildings, under-reamed bored compaction, precast spliced, skirted granular and pedestal piles; studies of foundation failures, geotechnical and soil investigations, georadar investigations and landslide related investigations and studies

- Studies of buildings in distress and remedial measures thereof, development of computer software for special structural problems, prestressed & prefabricated RCC flooring/roofing & walling components, prefab ferrocement building components

- Development of equipment for mechanising building construction activities, *in-situ* soil investigation, production of building materials and prefabricated building construction components

- Studies related to ventilation of residential & industrial buildings, chimney design for removal of smoke, orientation of buildings, design criteria for natural & artificial lights; thermal design of buildings, evaluation of insulating and acoustic performance of new materials



Brick making machine in operation

- Studies on fire hazard & analysis such as non-combustibility, ignitability, fire propagation, surface spread of flames, fire retardant treatments, post-fire investigations, development of fire alarm systems, sprinklers, extinguishing methods & equipment

Energy efficient gypsum calcinator

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

The institute has many patented processes/technologies under commercial production. Examples of the technologies transferred to industry are: semi-mechanized brick making machine, fly ash bricks, high draught kiln, lime shaft kiln, bored compaction piles, mini-climbing crane, mechanized pan system for calcination of gypsum, skirted granular pile foundation and solar timber seasoning kiln, etc.

TECHNOLOGIES READY FOR TRANSFER

- Fibrous gypsum plaster boards
- Improved lime kiln
- Pollution control system for lime kilns
- Solid prestressed concrete poles using direct electric curing
- Unreinforced pyramidal brick roof
- A variety of improved building materials
- Software packages for design of building structures

MAJOR FUTURE PROGRAMMES

The major future programmes of CBRI will relate to development, and upgradation and standardization of technologies towards greater automation introducing energy-efficient firing systems for improved production of bricks, performance and durability studies of building materials. Technology packages will be developed for housing in rural and urban situations using local materials and appropriate methods of construction. R&D programme will be geared up to provide substitutes for wood in buildings. Studies will be taken up on detection and suppression techniques for fire safety in buildings and development of fire retardant materials.

MAIN FACILITIES

- Modern analytical/characterization facilities
- Inclinometer, georadar, terrameter, GDS soil testing meter, laser particle size analyzer, electronic distance meter, etc.
- Foundation pile diagnostic system
- National fire testing facility
- Computer facilities
- A well-equipped workshop
- Library

Foundation pile diagnostic analyzer

SERVICES OFFERED

- Chemical characterization of various raw materials used in the manufacture of building materials
- Determination of physical and mechanical properties of building materials and components
- Testing of fire resistance properties of materials
- Architectural design of various kinds of buildings like rural and urban housing, school buildings, and health centre buildings, etc.
- Diagnosis of distressed structures and their rehabilitation by remedial measures, soil and rock characterization, soil investigations, stability analysis and recommendations for suitable foundation types
- Standardization of methods, processes, materials and components related to buildings

TRAINING PROGRAMMES

The institute conducts training courses for senior/junior professionals, entrepreneurs and craftsmen.

PUBLICATIONS

The institute publishes *Building Research Notes*, special publications, news letters and annual reports.

Contact Person : Director, CBRI

EXTENSION CENTRES

CBRI Extension Centre,
c/o School of Architecture,
Navrangpura
Ahmedabad 380 009

CBRI Extension Centre,
North I.T. Nagar,
Bhopal 462 003

CBRI Extension Centre,
6th Floor, Nizam Palace,
A-234, Acharya J.C. Bose Road,
Calcutta 700 020

CBRI Extension Centre,
c/o C.R.R.I,
P. O. CRRI, Mathura Road,
New Delhi 110 020

CBRI Extension Centre,
Research Station (B&R)
Errum Manzil
Hyderabad 500 481

CBRI Extension Centre,
c/o Kerala State Housing Board
Santhinagar,
Trivandrum 695 001.

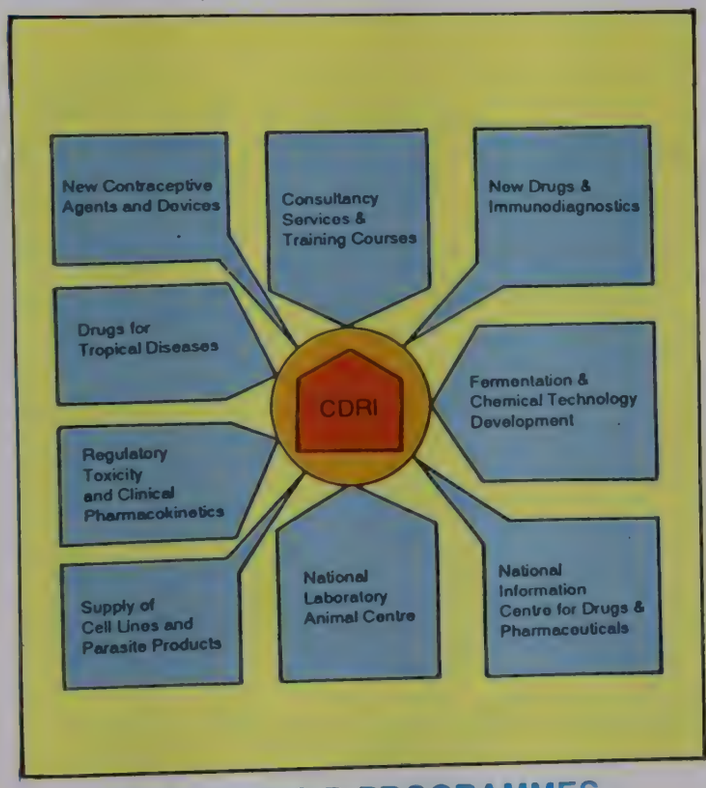
Central Drug Research Institute (CDRI)

Chattar Manzil Palace, Lucknow 226 001
Telephone: 234219, 243286 Telegram: CENDRUG, LUCKNOW
Telex: 0535-286/0535-344 CDRI IN E. Mail: cdrilk@sirnetd.ernet.in

Established: 1951
Director: Dr V.P. Kamboj, M.Sc., Ph.D., D.Sc.(Panjab), F.N.A.
Budget for 1992-93: Rs 798 lakh

MANDATE

- Development of new drugs, immunodiagnostics and vaccines
- Development of contraceptive agents and devices
- Basic biomedical studies to understand disease processes
- Systematic evaluation of natural resources for discovery of drugs
- Development of technology for drugs and intermediates, biologicals and fermentation products
- Dissemination of information in the field of drug research, development and production
- Consultancy and development of technical manpower


New Contraceptive Agents and Devices
Consultancy Services & Training Courses
New Drugs & Immunodiagnostics
Drugs for Tropical Diseases
CDRI
Fermentation & Chemical Technology Development
Regulatory Toxicity and Clinical Pharmacokinetics
Supply of Cell Lines and Parasite Products
National Laboratory Animal Centre
National Information Centre for Drugs & Pharmaceuticals

MAJOR R & D PROGRAMMES

Major R&D programmes are directed towards (i) development of contraceptives; new drugs for tropical diseases (malaria, filariasis, leishmaniasis), cardiovascular and central nervous system disorders, hepatoprotection and allergy; (ii) development of immunodiagnostics for early diagnosis of malaria, filariasis and leishmaniasis; (iii) development of vaccines for leprosy, malaria and cholera; (iv) exploration of terresterial plants, inlcuding Indian traditional remedies, and marine flora and fauna for novel molecules for drug development; (v) development of immunomodulators; (vi) development of cost-effective innovative chemical/fermentation technologies for the institute's new drugs, known drugs and drug intermediates, biologicals and fermentation products; (vii) basic research on biology of reproduction, host-parasite bio-chemical mechanisms, regulation of CVS and CNS functions and enzyme and receptor studies to obtain 'new leads' for drug development.

Automatic DNA synthesizer

SIGNIFICANT ACHIEVEMENTS

- Development of 8 new drugs/products: a nonsteroidal contraceptive for females (Centchroman); a cervical dilator for medical termination of pregnancy (Isaptent);

for hyperlipidemia (Gugulipid); for local anaesthesia (Centbucridine); for schizophrenia (Centbutindole); for thyrotoxicosis (Centimizone); for early diagnosis of filariasis and leishmaniasis (immunodiagnostic kits)

- Development of standardized fraction of active plants as drugs (Gugulipid and Picroliv)
- Technology for producing specific antisera against BSA-steroid hormone conjugates and master standards of hormones required for preparation of kits for diagnosis of hormonal disorders
- Development of a simple and economical 'paper strip test kit' for quality control check-up of iodised salt
- Technology for Biocide (*Bacillus sphaericus* spore toxin formulation), mosquito larvicide for vector control

Facility for the production of biocide

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Centchroman marketed under the trade names Saheli and Centron (Hindustan Latex Ltd, Trivandrum and Torrent Pharmaceuticals Ltd, Ahmedabad); technology also transferred to Beximco Pharmaceuticals Ltd, Dhaka, for marketing in Bangladesh
- Gugulipid marketed under the trade name Guglip (Cl-PLA Ltd, Bombay); technology also transferred to Arkopharma Laboratories, France for commercialization in EC countries
- Centbucridine released for marketing under the trade name Centoblok (Themis Chemicals Ltd, Bombay)
- Centimizone released for marketing (M.M. Laboratories Ltd, Ghaziabad)

Centchroman, a non-steroidal oral contraceptive for females, developed by CDRI

- Isaptent marketed under the trade name Dilex-C (Unichem Laboratories Ltd, Bombay)
- Immunodiagnostic kits for eary diagnosis of filariasis marketed (Malladi Drugs & Pharmaceuticals Ltd, Madras)
- Fermentation technology for commercial production of l-ephedrine hydrochloride (Malladi Drugs & Pharmaceuticals Ltd, Madras); l- ephedrine hydrochloride and pseudoephedrine (Krebs Biochemicals Ltd, Hyderabad)
- Fermentation technology for commercial production of l- acetylphenyl carbinol (Altus Pharma Tech Pvt. Ltd, Bombay)
- Chemical technology for commercial production of dextropropoxyphene hydrochloride (Wockhardt Pvt. Ltd, Bombay)
- Chemical technology for the manufacture of Pyrithioxin (Themis Chemicals Ltd, Bombay)
- Chemical technologies for some other drugs/drug intermediates, e.g., Clofazimine, Ibuprofen, D-2-aminobutanol, N- methylpiperazine, etc. in commercial production

TECHNOLOGIES READY FOR TRANSFER

- Centbutindole, a neuroleptic drug for management of schizophrenia
- Prednisolone, production from hydrocortisone

MAJOR FUTURE PROGRAMMES

The institute will continue its efforts for development of new drugs, diagnostics and vaccines and develop knowhow for their commercial production. Major efforts will be directed towards antifertility, and tropical diseases.

Drugs/products for which technologies will be available for transfer in the near future are:

- Centpropazine, antidepressant drug
- Compound 81/470, broad spectrum anthelmintic for veterinary/medical use
- Consap, a spermicidal cream, for use as a local contraceptive
- Compound 80/53, antirelapse antimalarial
- Compound 80/574, hypolipidaemic
- Arteether, antimalarial
- Centbutindole, injectable neuroleptic
- LDH-based diagnostic kit for malaria
- Antigen-based diagnostic kit for filariasis

MAIN FACILITIES

- Sophisticated instrumental facilities for characterization and structure elucidation of chemicals and electron microscopic study

Cell lines and tissue culture facility

- Computer-aided drug design
- Modern analytical and testing facilities
- Biological screening in about 100 test systems, regulatory toxicity testing
- Animal house
- Facilities for fermentation studie

SERVICES OFFERED

CDRI offers consultancy in technology upscaling of drugs and development of laboratory animal facilities to industry, R&D institutions and others; undertakes contract research as sponsored, collaborative and grant-in-aid projects. The laboratory clientele includes Astra-IDL, CIPLA, Malladi, Themis, Torrent, Wockhardt, Arkopharma (France) and Beximco (Bangladesh).

The institute provides analytical and testing services to academia and industry and supplies laboratory animals including specific pathogen-free (SPF) animals, cell lines, and parasites and parasite products

The National Information Centre for Drugs & Pharmaceuticals located at CDRI has access to international databases and caters to information needs.

TRAINING COURSES

Short-term ad-hoc training in techniques in drug research is provided to persons from academic organizations and industry; a regular training course is conducted in laboratory animal science.

PUBLICATIONS

Reports published under the 'Drug Research Perspective Series', annual reports and information brochures.

Contact Person: Dr Zaka Imam, Technical Information, Industrial Liaison and Planning Division.

DATA STATIONS/EXTENSION CENTRES

Neuropharmacology Unit,
K.G.'s Medical College,
Lucknow

Clinical Pharmacology Unit,
K.G.'s Medical College,
Lucknow

Clinical Pharmacology Unit,
Seth G.S. Medical College & K.E.M. Hospital,
Parel, Bombay.

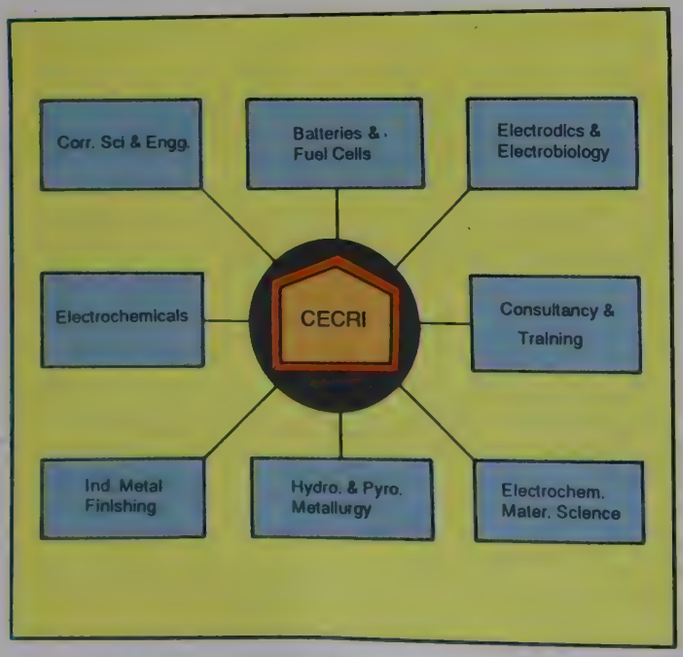
Central Electrochemical Research Institute (CECRI)

Karaikudi 623 006
Telephone: 2064 & 2088 Telegram: CECRI, KARAIKUDI
Telex: 0443-211 ECRI IN FAX: 91-4565-2088 E. Mail: cecrik@sirnetb. iisc.ernet. in

Established: 1953
Director: Prof. G.V. Subba Rao, Ph.D., F.R.S.C. (Lond), C.Chem. F.A.I.C. (USA), F.A.Sc., F.N.A.
Budget for 1992-93: Rs 639 lakh (RE)

MANDATE

- To conduct research in different areas of electrochemistry and allied fields
- To develop new processes and products in the areas of its specialization with a view to providing import substitution and increasing export potential of the country
- To help both the Indian industry and government departments through consultancy, contract research and training
- To contribute to human resource development through formal university level courses in electrochemical engineering and technology and refresher courses in corrosion prevention, industrial metal finishing, batteries, etc.



MAJOR R & D PROGRAMMES

The major R&D programmes of CECRI relate to batteries and power sources, corrosion science and engineering, electrochemicals, electrochemical materials science, electrohydrometallurgy, electropyrometallurgy, electrochemical instrumentation, electrodics and electrobiology and industrial metal finishing. Basic research also forms an important part of the R&D programmes of CECRI.

SIGNIFICANT ACHIEVEMENTS

- Technologies have been developed for making lead-acid batteries for normal and low temperature applications and maintenance-free (MF) lead-acid batteries of capacities up to 12 V/100 Ah; deep discharge lead-acid batteries manufactured using CECRI knowhow are being used for powering stand-alone lights in rural areas under the Literacy Mission and in uninterrupted power supplies (UPS) in computer installations.
- Technology has been developed for nickel electroforming of the thrust chamber of the cryogenic rocket engine for ISRO.
- Technology developed for the production of titanium substrate insoluble anodes (TSIA) is being widely used in the chlor-alkali and other electrochemical industries and has led to savings of millions of rupees in the chlor-alkali sector alone.

Selectively coated coloured stainless steel utensils in a solar cooker

- Processes have been developed for the energy-efficient production of potassium perchlorate, potassium iodate and calcium gluconate.

- Technologies have been developed for the production of sodium, misch metal (mixture of rare earths) and chromium powder, and for the recovery of gallium from Bayer liquor.

- Process knowhows have been developed for the production of magnesium-silver chloride, magnesium-cuprous chloride and nickel- iron batteries.

- CECRI process for copper plating of stainless steel vessels is widely used to save on cooking fuel. Technology has also been developed for colour coating of stainless steel for decorative applications.

- CECRI has developed sacrificial alloy anodes for the cathodic protection of submerged steel structures (e.g. offshore oil platforms) and ocean going vessels.

- Knowhows have been developed for several corrosion inhibitors.

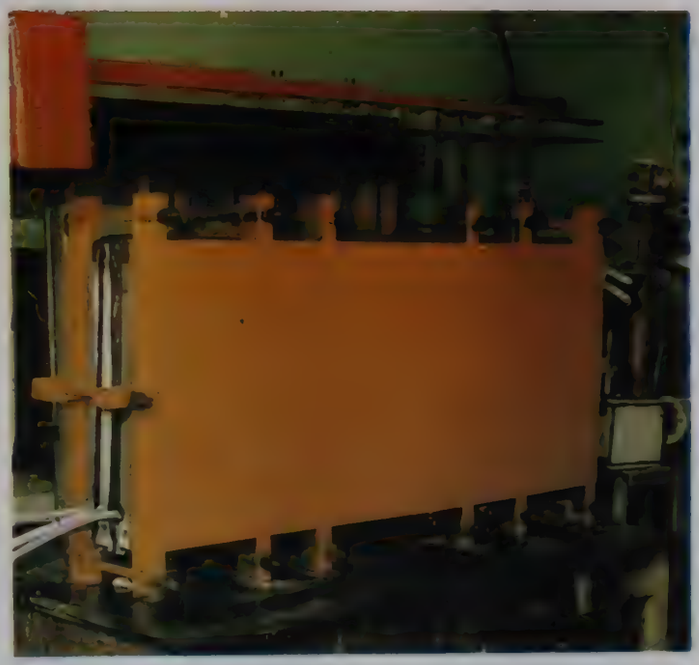
- CECRI has developed expertise for monitoring corrosion levels in bridges and innovative solutions for protecting prestressed steel in concrete structures; knowhow has also been developed for supervisory control and data acquisition (SCADA) for monitoring corrosion rates in offshore structures automatically and applying corrective measures by remote control. This is being used at Madras Port Trust.

- Technology has been developed for road-marking paints, daylight phosphors and phosphors for fluorescent lamps.

Supervisory control and data acquisition (SCADA) system for cathodic protection of off-shore platforms

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Titanium substrate insoluble anode (TSIA)
- Zinc ethyl silicate primer; S R H S chrome salt
- Copper plating/colour coating of stainless steel vessels
- Al-Zn-In and Zn-Mg sacrificial anodes
- Ion-selective electrodes
- Magnesium cuprous chloride battery, magnesium silver chloride battery, lead-acid battery, maintenance free lead-acid battery and paste type deep-discharge lead-acid battery
- Calcium gluconate, potassium iodate, potassium chlorate, calcium carbide and ammonium perchlorate
- Membrane cell for the production of potassium hydroxide and sodium hydroxide
- Electroforming of engineering components



Bipolar membrane cells for caustic soda and caustic potash

- Electrophoretic paint; blue phosphor
- Anti-corrosive treatment for steel reinforcement rods
- Chromium and sodium metals
- Rust converter

TECHNOLOGIES READY FOR TRANSFER

- Aluminium alloy anodes for cathodic protection (based on indium)

- Anti-tarnishing lacquer for copper and its alloys
- Stationary paste type deep-discharge lead-acid batteries
- Platinum and palladium plating solution concentrates
- Technologies for gold plating
- Rust-converting primer
- Reflecting road marking paint; fluorescent paints for sign boards
- Inhibitor admixture for cement grout used in protecting pre-stressing steel; solution for protection of pre-stressing steel in cable ducts
- Lithium-manganese dioxide button cell (capacity 3V/500mAh)
- Air drying synthetic enamel paint
- Nickel-iron alloy plating; brightener for nickel plating
- Maintenance-free lead-acid battery for use in emergency light

MAJOR FUTURE PROGRAMMES

In tune with the new economic policy, CECRI plans to concentrate on a few selected areas and meet prospective clients more than half way through sustained marketing thrusts. Research will concentrate on concrete structures, power sources for electric vehicles, fuel cells and new materials.

Betatron system — a radiographic instrument acquired by CECRI for inspection of concrete bridges

MAIN FACILITIES

- Modern analytical facilities, e.g., high performance liquid chromatography, gas chromatography, gel permeation chromatography, IR, UV and atomic absorption spectrophotometers, X-ray powder diffractometer, scanning electron microscope, and elemental analyzer. A betatron radiographic instrument for monitoring corrosion in reinforced and prestressed concrete structures
- Microvax computer system
- Facilities for testing batteries (at Madras unit)

SERVICES OFFERED

CECRI offers consultancy services to industry, R&D units and government agencies within and outside India and undertakes sponsored research in all areas of electrochemistry. The institute has helped in setting up a calcium carbide plant in Myanmar

The institute provides testing and analytical services to industry, particularly for batteries, paints, coatings, electrodeposits, inhibitors, etc.

TRAINING COURSES

CECRI conducts technology-oriented refresher courses in the areas of batteries, corrosion prevention, metal finishing and pollution control and training courses for industries, R&D organizations, and educational institutions.

A 4-year B.Tech. programme of the Madurai Kamaraj University is being offered at this institute covering the areas of electrochemical engineering and technology.

PUBLICATIONS

Bulletin of Electrochemistry (Monthly), *CECRI News* (Bimonthly), *Battery Newsletter* (Bimonthly), *STED Newsletter* and its annual reports.

Contact Person: Director, CECRI

FIELD STATIONS/EXTENSION CENTRES

CECRI Madras Unit
CSIR Madras Complex, TTTI,
Taramani, Madras 600 113

CECRI Cochin Unit
Industrial Development Plot
Kalamassery (South)
Ernakulam 683 109

CECRI Corrosion Research Centre
Mandapam Camp-635 519

CECRI Tuticorin Unit
Harbour Area
Tuticorin 628 004

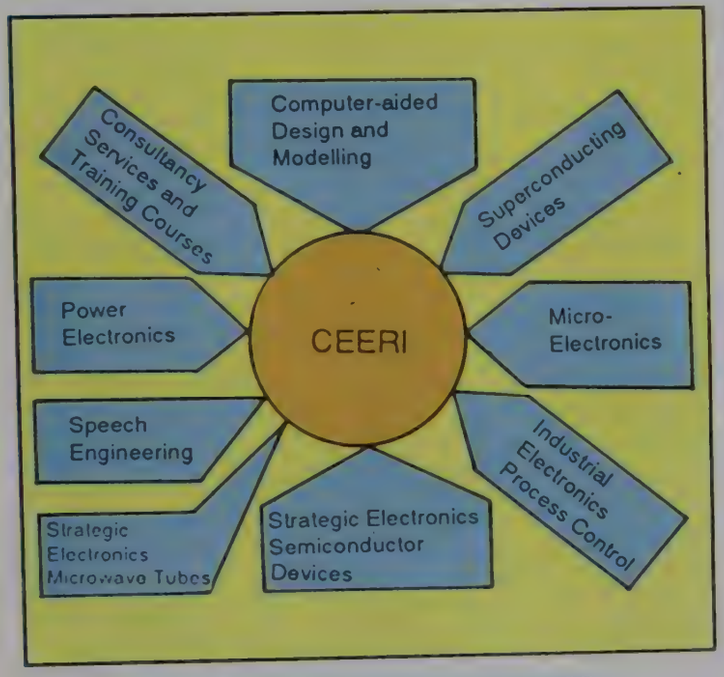
Central Electronics Engineering Research Institute (CEERI)

Pilani 333 031
Telephone: 015951 - 2111, 2229 Telegram: ELECTRONIC PILANI
Telex: 031-77111 FAX: 015951 - 2294 E. Mail: ceeri@sirnetd.ernet.in

Established: 1953
Director: Prof. R.N. Biswas, Ph.D.
Budget for 1992-93: Rs 620 lakh

MANDATE

- To carry out R&D in electronic devices and systems
- To assist industry in technology absorption, upgradation and diversification
- To provide R&D services to industry and users in design, fabrication and testing
- To provide technical services for specific needs of high precision and quality



MAJOR R&D PROGRAMMES

The R&D programmes of the institute are responsive to the emerging needs of the country in the following areas:

- *Microelectronics* — LSI/VLSI circuits, design and prototype fabrication of ASICs, power semiconductor devices, multilevel hybrid microcircuits, etc.
- *Strategic Electronics* (Semiconductor Devices) — W-Band millimetre wave impatt diodes and GaAs devices; Microwave Tubes — Design and prototype fabrication of power TWTs, magnetrons, crossed field amplifier, fast wave microwave tubes, miniature magnetron, S-band 5-MW pulsed klystron, type-M dispenser cathodes
- *Industrial Electronics* — Microprocessor- and PC-based control systems for sugar, tea, leather, dairy, pulp, paper and textile industry; energy-efficient drive and power electronic systems for industry, Data Highway, Maplan, drip irrigation system, colour graphics, and digital mapping system
- *Museum Electronics* — Audio-visual systems and speech engineering with special reference to voice communication with machines, synthesis for Indian languages

Silicon DDR impatt diodes for 100 GHz developed by CEERI

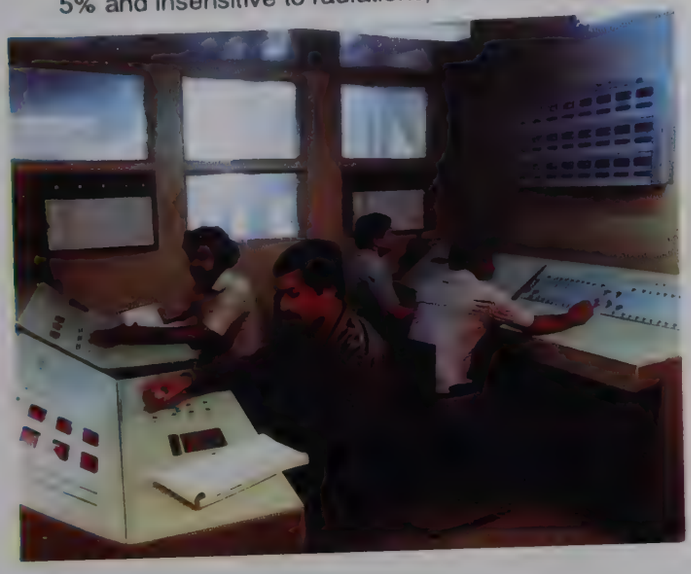
SIGNIFICANT ACHIEVEMENTS

Microelectronics

- Development of '3 micron CMOS technology'
- Designing of serial data communication controller chip, microwave oven controller chip and data acquisition chip for user agencies
- Development of several types of 'hybrid microcircuits' to space qualification level for use by ISRO in their

'INSAT-IIB satellite; thick film process technology knowhow transferred to industry

- Development of 'neutron dosimeter' with voltage sensitivity 1 millivolt/rad, forward voltage 1.2 volt, fading 5% and insensitive to radiations, for a user agency



Microprocessor-based control systems for sugar industry

Strategic Electronics

- Development of more than 200 packaged W-band silicon pulsed DDR impatts giving power output in the range of 8 watts, over 100 nsec pulse duration and 10 kHz PRF for a user agency
- Development and export to UK of software for design of TWT
- Development of conventional and alloy film type-M dispenser cathode with the specifications: 20 A/cm^2 (alloy film Type-M); expected life time: 20,000 hours

Industrial Electronics

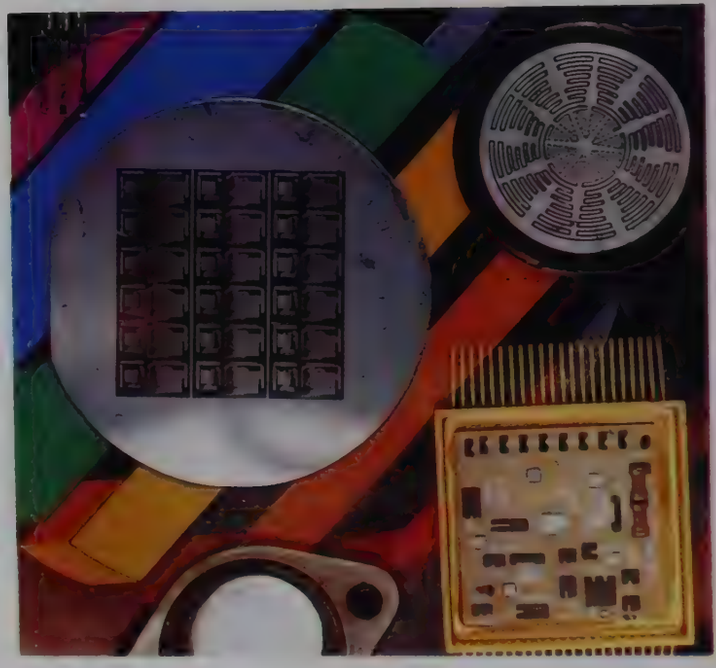
- Installation of 16-channel on-line display of the control status in the control system for juice evaporation stage at the Simbhaoli Sugar Mills
- Implementation of 'MAP Compatible Local Area Network (MAPLAN) CB- 31' with onboard 80186 CPU to handle all communication tasks between two nodes with the development of necessary software; and handing over the designs to ECIL, Hyderabad, for engineering models
- Development of 'Automatic drip irrigation system' consisting of 8085-based control board, stand-alone stepper motor driver, moisture sensing probes and its associated signal processing circuits, its testing and handing over to Vasant Dada Sugar Institute, Pune, the collaborators for user data
- Production of 150W chargeable power pack (CPP) units for National Literacy Mission

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- 100 VA Uninterrupted power supply (UPS)(Shakti Electronics, Jaipur; Sagar Electricals, Ambala Cantt; Electronic Corporation of Tamil Nadu, Madras; Tele Systems, Pilani)
- Microprocessor-based pan monitoring system (MIPMOS) [Satwik Electric Controls Pvt Ltd, Nasik; Pyrotech International, Udaipur; Prabhakar Engineers (P) Ltd, Pune]
- Microprocessor-based system for monitoring & controlling of temperature (Micro-TEIMAC) [Satwik Electric Controls Pvt Ltd, Nasik; Naina Electronics (P) Ltd, Chandigarh]
- Zirconia oxygen analyzer (Instrumentation Ltd, Kota; Kerala State Electronic Development Corporation, Trivandrum; EMP Controls Pvt. Ltd, Bombay)
- 2kVA DC to DC converter [Metallergical & Engineering Consultants (India) Ltd, Ranchi]
- Word recognition system for voice operated machine (B.M. Birla S&T Centre, Jaipur)
- SOFTWARE 1-D large signal model for helix TWT [University of Lancaster, Lancaster (UK)]

TECHNOLOGIES READY FOR TRANSFER

- Microprocessor-based automatic *p*H control system (MAPCON), microprocessor-based pan monitoring system (MIPMOS), monitoring system (MICROMON), and automatic centralized industrial temperature indicating, monitoring and control system (Micro- TEIMAC) for sugar industry.



Transistors, VLSI, darlington power diode and integrated circuit developed by CEERI

- Yttria-stabilized zirconia oxygen monitoring system
- 100 VA uninterrupted power supply, 150 VA (12V) chargeable power supply, 500 VA UPS (low frequency)
- Digital work station for mapping application and discrete data capture system
- Type M dispenser cathodes for microwave tubes
- Millimetre wave impatt diode for W-band
- Wide-band high speed AC/DC high current sensor
- Word recognition system
- Non-destructive vacuum measuring system (VIBROTOME) for canned food products
- On-line instrumentation for real time monitoring of low-pulp consistency (LOCOMON) for paper & pulp industry
- Microprocessor-based telephone exchange
- Miltilevel hybrid microcircuit
- Power darlington transistor (100 A, 400 V)

MAJOR FUTURE PROGRAMMES

The future programmes of CEERI will be directed towards the development of high-end special-purpose microchips, power semiconductor devices, multilevel hybrid micro circuits, materials growth for MM wave devices, optoelectronic integrated circuits, integrated electronic systems for sugar, tea, dairy, rubber, leather and textile industries, energy efficient power electronics systems, semiconductorintegrated sensors and microwave tubes, voice-operated machines, CAD tools, mathematical analysis and simulation software for specific use.

A telephonic system

MAIN FACILITIES

- Design facility for computer-aided design (CAD) of ICs and discrete semiconductor devices & microwave tubes
- Fabrication facility for semiconductor devices and microwave power tubes
- Instruments & controls system design, testing and microprocessor development facilities
- Mechanical workshop, computers, testing and calibration facilities
- Library

SERVICES OFFERED

CEERI offers consultancy services for new designs, and upgradation and absorption of technology to industry, R&D units, project engineering organizations and undertakes contract research on specific problems and requirements of electronic industry.

TRAINING COURSES

The laboratory conducts collaborative manpower development programmes with academic institutions. It also conducts training courses for industry, R&D organizations and educational institutions in the area of its activities.

PUBLICATIONS

The laboratory publishes *CEERI Newsletter* (quarterly), brochures and its annual reports.

Contact Person: Director, CEERI

FIELD STATIONS

CEERI Delhi Centre,
CSIR Complex, NPL Campus,
New Delhi 110 012
Telegram: CEERICENT

CEERI Madras Centre
CSIR Complex, Adyar
Madras 600 020
Telegram: CONSEARCH

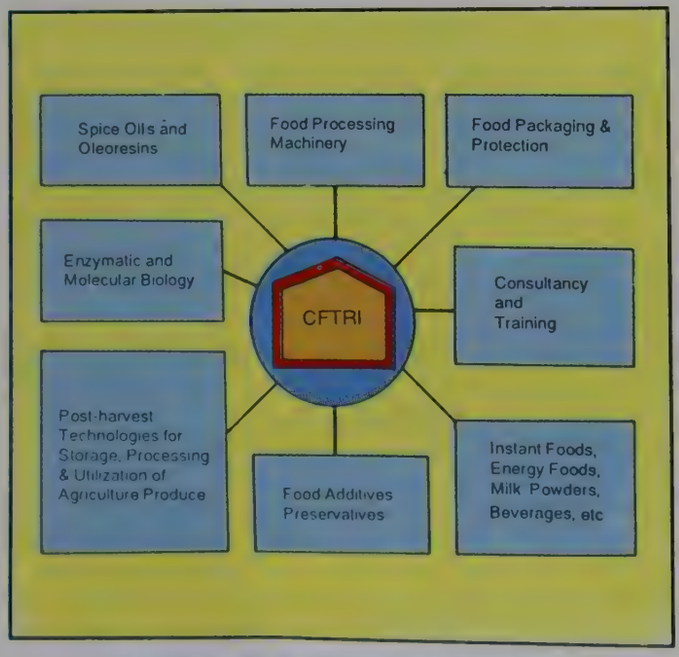
Central Food Technological Research Institute (CFTRI)

Mysore 570 013
Telephone: 32770 Telegram: FOODSEARCH MYSORE
Telex: 846 - 241 FTRI FAX: (91) 0821 - 27697 E. Mail: nicfos.ernet.in

Established: 1950
Director: Prof. S.R. Bhowmik, B.Tech., Ph.D. (Rutgers)
Budget for 1992-93: Rs 670 lakh

MANDATE

- To carry out research and development work relating to food processing and conservation
- To help in increasing efficiency and productivity in food industry through development of appropriate technologies
- To assist in establishing and managing food industrial units
- To plan and implement an effective information dissemination programme in post-harvest technology
- To assist food industry through consultancy, contract research and other technical support services
- To train personnel and develop capability for carrying out R&D in the area of food processing and conservation


Spice Oils and Oleoresins
Food Processing Machinery
Food Packaging & Protection
Enzymatic and Molecular Biology
CFTRI
Consultancy and Training
Post-harvest Technologies for Storage, Processing & Utilization of Agriculture Produce
Food Additives Preservatives
Instant Foods, Energy Foods, Milk Powders, Beverages, etc

MAJOR R & D PROGRAMMES

The major activities of the institute relate to development of food products and processes for optimal utilization of country's agricultural produce; modernization of primary processing industry; development of value-added convenience products; upgrading traditional food technology & development of appropriate technologies for reducing/eliminating post-harvest losses of perishables and durables; basic research related to food additives, preservatives, micronutrients, food toxicity and safety, food microbiology, enzymatic and molecular biology, bioactive substances and food packaging.

SIGNIFICANT ACHIEVEMENTS

- Development of indigenous infant food formulation using buffalo milk which has laid the basis of flourishing baby food industry in the country
- Harnessing of plant proteins for use as nutritious base for a variety of food supplements such as energy food, weaning foods and miltone

Infant food based on CFTRI technology

- Development of improved technology which has led to increase in the yields of rice, dhal, flours from staple cereals and pulses
- Development of formulated products with built-in convenience features for preparing traditional snack items of India

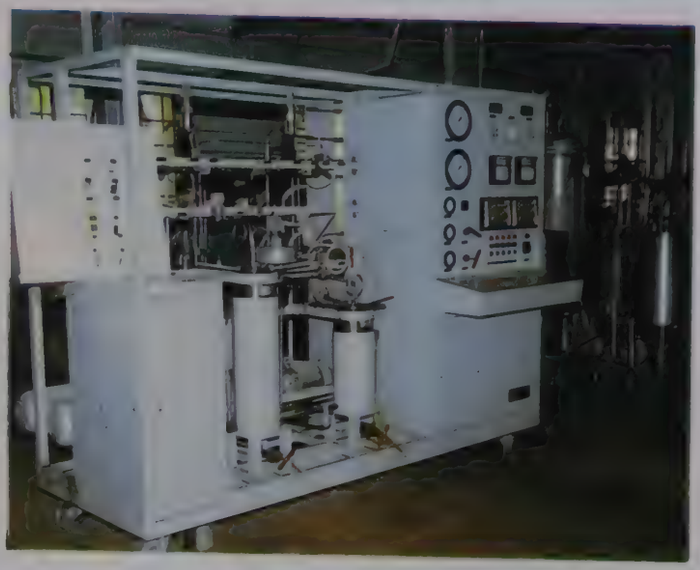
- Development of indigenous technology for production of spice oils and oleoresins which has led to saving of valuable foreign exchange
- Indigenous technology for fermentation and drying of cocoa, production of cocoa mass, cocoa butter and cocoa powder
- Development of indigenous flavour concentrates for manufacture of aerated beverages such as orange, lime and cola beverages

Unit for making encapsulated flavoured concentrates for aerated beverages

- Technologies for protecting foodgrains from microbes, insects and rodents
- Technology for manufacture of plant growth hormones from agricultural wastes with growth promoting potential to the extent of 15-30%

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Infant food from buffalo milk (Amul Cooperative, Anand)
- Optimised infant food formulation (Dalmia Dairy, New Delhi)
- Protein isolate from oilseed meals (TOMCO, Bombay)
- High quality egg powder from fresh eggs (Foods & Inns, Bombay)
- Spice oils and extractives (Synthite Industrial Chemicals, Cochin)
- Cola beverage concentrate (Modern Food Industries Ltd, New Delhi)
- Natural colours from raw materials like kokum, safflower petals, beet-root and blue grapes (Roha Dichem, Bombay)



Supercritical extractive system for spice extractives

- High quality raisins from Indian grapes (Harmonic Foods, Bangalore)
- Curcumin concentrate from turmeric oleoresin (Bombay Oils, Cochin)
- Chitosan from shrimp industry wastes (Chemopal Complex, Madras)
- Aflatoxin decontamination in groundnut oil (Voltas, Bombay)
- N-Triacontanol, plant growth promoter (Saklashpur Agro-Chemicals, Saklashpur, Karnataka)
- Tomato concentrate production system (Larsen & Toubro, Bombay)
- Recovery of oil, citrate and pectin from lime fruits (Southern Citrus Products, Gudur)
- Animal feed formulation from agricultural wastes (Amarnath Feeds, Mysore)
- Alcohol from tapioca (Coimbatore Alcohol Products, Coimbatore)
- Energy food formulation for national nutrition intervention programmes (Karnataka Agro-Corn Products, Bangalore)
- Dehulled sunflower seeds (Tamilnadu Agro-industries Corporation, Madras)
- Free-flowing compounded asafoetida powder (Mittulal Lalah & Sons, Madras)

TECHNOLOGIES READY FOR TRANSFER

- Pheromone-based formulation for foodgrain storage
- Improved yeast strain technology for alcohol production
- Mechanized unit for *chapati* production

- Encapsulated food flavours
- Harmless herbal formulation as mosquito repellant

MAJOR FUTURE PROGRAMMES

- R&D rationalization of energy input in food processing system
- Reduction of post-harvest losses in raw-materials
- Upgrading technology for food quality, safety and productivity with special reference to traditional foods
- Speciality foods for targetted specific groups
- Development of technologies with export potential
- Basic research in frontier areas with long-term application potential

MAIN FACILITIES

- Modern pilot plants with state of art equipment (both imported and indigenously fabricated) to carry out different unit operations involved in food processing
- A modern design centre & workshop for inhouse fabrication of protoypes
- A functional package testing laboratory for assessing packaging materials
- A 20-tonne Buhler roller flour mill
- A training abattoir with facilities for processing large, medium and small animals
- Modern analytical facilities
- A library with more than 16,000 publications and 600 journals and periodicals serving as National Information Centre for Food Science & Technology under NISSAT scheme

SERVICES OFFERED

CFTRI offers a variety of user-oriented services including analytical and quality control guidance; industrial consultancy for food-based projects; contract research for product development as well as trouble shooting; pilot plant production for marketing studies; sensory assessment and market acceptance studies; testing of packaging materials and food packaging assistance; specialized bibliography and technical reports; technology update services for small scale industries.

TRAINING COURSES

- CFTRI conducts short-term programmes in more than 45 specialized areas of food science & technology for industry personnel
- The institute is affiliated to the University of Mysore for running a 2-year M.Sc. course in Food Technology.

Energy food plant

- International School of Milling Technology at the institute offers a one-year certificate course supported by Roller Flour Millers Federation of India and Government of Switzerland.

PUBLICATIONS

Food Technology Abstracts (monthly)

Food Digest (quarterly)

Food Patents (quarterly)

Techno-economic News (monthly)

CFTRI Newsletter (bimonthly)

Contact Person: Director, CFTRI

REGIONAL CENTRES

CFTRI Regional Centre
Bhavan's College Campus, Andheri (West),
Bombay 400 058
Tel: 6231599; Gram: FOODSEARCH, BOMBAY

CFTRI Regional Centre
UPSIDC Industrial Area, Chinhat-dewa Road,
Lucknow 227 105
Tel: 382516; Gram: FOODSEARCH, LUCKNOW

CFTRI Regional Centre
Uppal Road, Near IICT Campus, Hyderabad 500007
Tel: 854125; Gram: FOODSEARCH, HYDERABAD

CFTRI Regional Centre
Fisheries College Campus, Hoige Bazaar,
Mangalore 575 001
Tel: 24304; Gram: FOODSEARCH, MANGALORE

CFTRI Regional Centre
PO Gurunanak Engineering College, Gill Road,
Ludhiana 141 006
Tel: 24569; Gram: FOODSEARCH, LUDHIANA

CFTRI Regional Centre
Gole Bungalow, Chhindwara Road,
Nagpur 440 013
Tel: 534571; Gram: FOODSEARCH, NAGPUR.

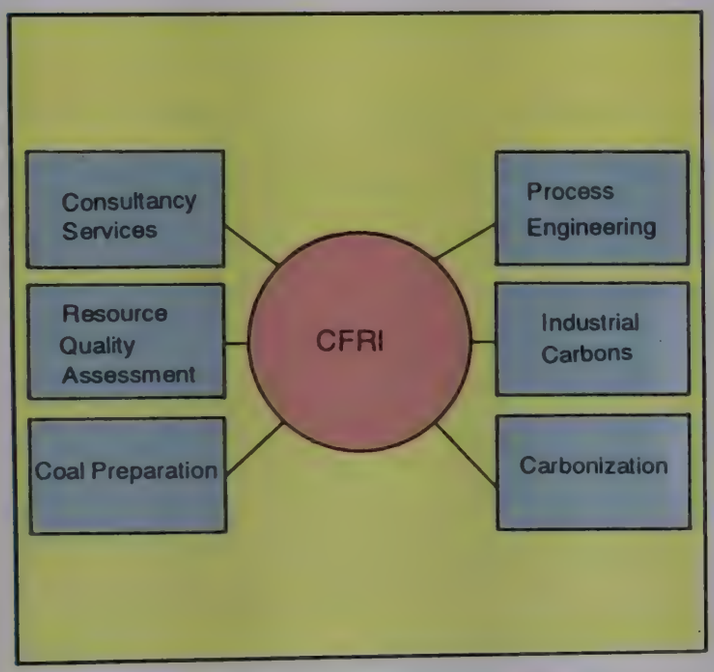
Central Fuel Research Institute (CFRI)

Dhanbad 828 108
Telephone: 60141 & 61807 Telegram: RESEARCH, FRI DHANBAD
Telex: 0629-201 CFRI IN FAX : 91 (0326) 61807

Established: 1946
Director: Dr Kotur S. Narasimhan, Ph.D (Fuel Tech/Chem. Engg., Sheffield, UK)
Budget for 1992-93: Rs 632 lakh

MANDATE

- To conduct research in different areas of fuel science and technology with emphasis on coal
- To develop new technologies for gainful utilization of coal in the country and for promoting import substitution for coking coals
- To assist the coal utilizing industries through consultancy, sponsored research and training
- To develop environment-friendly energy management systems taking into account the needs of coal, steel, power, chemical and allied industrial sectors, both within the country and outside



MAJOR R&D PROGRAMMES

Major R&D programmes of CFRI relate to coal preparation (from laboratory to continuous pilot plant scale), coal carbonization for assessing coking characteristics of coal for different metallurgical applications and formulations of coal blends for the steel industry, development of various processed fuels, development of pollution control measures for coal-based industries, waste utilization, characterization of coals, lignites, cokes and related products, and process engineering for coal conversion technologies.

SIGNIFICANT ACHIEVEMENTS

- Use of CFRI-proposed technologies in all the 22 existing central washeries (installed capacity 38 million tonnes of coal per year) and upgradation of high ash Indian coals by beneficiation to augment coking coal reserves in the country
- Selection of optimum coking blends for public sector steel plants, characterization of available coking coals, commissioning of coke oven batteries, development of improved designs for beehive coke ovens (non-recovery type) and standardization of specifications and testing of coke for BIS
- Development of solvent refined coal (SRC), a coking additive, from non/weak-coking coals that would help reduce prime coking coal component or imported coal blends in the coke ovens of the steel plants
- Chemical desulphurization of coals with high sulphur content
- Process development of indigenous sand for caking index (import substitution) and reactivity of coke/char, development of carbon molecular sieve for gas separation, utilization of low ash metallurgical coke (LAMC) as heating medium in the production of synthetic graphite and substitution of electrically calcined anthracite by LAMC for alumina reduction cell
- Basic studies on the structure of coal that have led to valuable information useful in the production of coal fertilizer, sponge iron using non-coking coal, briquetting and formed coke, prediction of tar formation, demineralization of coal and auto oxidation and spontaneous combustion in mines and stacks
- Process for building bricks using fly ash (80%), sand and lime
- Development of a series of zeolite catalysts for the production of industrial chemicals like 2-, 3- & 4-picolines and pyridine
- Development of modified, new generation catalysts for synthesis of olefins and liquid fuels from syngas
- Improvement of tar/pitch for use as binders for basic refractory bricks
- Multi-stage hydrogenation of coal in autoclaves for high yield of synthetic crude

- Laboratory scale development of a process for 70% conversion of carbon in non-coking coal into acetylene, using hydrogen-enriched organ plasma pyrolysis of coal
- Monitoring of air, water, soil and affluents with a view to combating environmental pollution by different industries; evolving national standards for SPM in stack emissions of coke ovens and briquetting plants; collaboration with MOEF for total methane budget from Indian paddy fields; study of CO_2 emission from coal-based industries; and utilization of fly ash in agriculture as a source of essential plant nutrients and soil conditioner
- Development of two coke/coal-based efficient domestic *chulhas* under NPIC of Department of Non-conventional Energy Sources.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Beta-naphthol from naphthalene (Eastern Naphtha Chem, Dhanbad and Oswali Chemicals, Bangalore)
- Domestic *chulha* technology (DNES)
- LAMC resistor coke as heating medium in the production of synthetic graphite (Hindustan Electro-Graphite, Bhopal)
- Building bricks from fly ash (14 firms located at Calcutta, Raichur, Patna, Vijaywada, Bandel and New Delhi)
- CFRI-TISCO design beehive coke oven (eight firms located at Jamshedpur, Calcutta, Ranchi, Nagpur and Bankura)

Kumbraj ovens based on CFRI technology

- Kumbraj beehive coke oven (Brahmdeo Sinha & Co, Jharia and Bala; Coke Industries Pvt. Ltd, Calcutta)
- Formed coke technology (nine firms located at Calcutta, Ranchi, Bokaro, Manmad, Hazaribagh and Dewas)
- Smokeless domestic briquettes from low-grade coal/washery byproducts (Coke Gul Industries, Dhanbad; Trident Coke Co., Dhanbad; Deepshikha Enterprises, Kanpur; and D & J Coal Briquettes Mfg. Co. Assam)
- Oleo-flotation process for integrated beneficiation and dewatering of coking coals (BCCL, Dhanbad)
- Oil-agglomeration process for recovery of additional cleans from inferior coals or middlings (CMPDI, Ranchi)
- Pyridine and picoline (Subhra Chem, New Delhi)
- Anthraquinone (Bhilai Engg. Corpn, Bhilai)

TECHNOLOGIES READY FOR TRANSFER

- Synthesis of 2-, 3- & 4-picolines and pyridine
- Synthesis of 3- & 4- cyanopyridine and their subsequent conversion to amides
- Synthesis of cresol and resorcinol from toluene and benzene respectively
- Purification of anthracene and its subsequent conversion
- Conversion of toluene to benzaldehyde

Automatic proximate analyzer for coal

- Substituted natural gas (SNG) from coal
- Demineralization of coal by alkali (bench scale)
- Production of pure silica and oxalic acid from paddy husk (lab scale)
- Process for stabilized coal-oil mixture

- Domestic *chulha* CFRI improved designs
- Substitution of electrically calcined anthracite by LAMC for alumina reduc-cell

MAJOR FUTURE PROGRAMMES

Coal preparation will continue to be the focus of major activities. Assessing and improving the performance of existing washeries, optimising yields and suggesting improvement through modernization and adoptation of newer technologies will be the major areas of interest.

With a view to reducing dependence on import of coking coal for the steel plants, CFRI will develop new coking additives like SRC besides carrying out R&D on frontier technologies of coke making like stamp-charging, preheating, formed coke, partial briquetting & coal charging, etc. In addition, studies on metallurgical coke making in non-recovery type coke ovens utilizing lower seam coals of Jharia coalfield will be taken up.

Environmental problems caused by coal-based industries will be studied with a view to controlling pollution hazards.

Design and development work for the mini-washeries, inert-gas generators, producers, fluid-bed gasifiers and combustors, etc., preparation of coal-water and coal/lignite-oil slurries and their transportation and combustion will be underaken. Work on coal constitution and elucidation of coal structure with implied industrial significance will continue.

MAIN FACILITIES

- The institute has the following pilot plant and test facilities: Test coke ovens, coal-oil stabilized slurry unit, fluidized bed combustor, fluid bed hot air generator, oil- agglomeration bench scale unit, heavy medium cyclone plant and hydrocyclone unit, floatation cell (40 kg/hr), high pressure coal hydrogenation pilot plant, catalyst unit (140 ml) for conversion of syngas to liquid fuels, low pressure briquetting plant, briquette curing plant, Fischer Tropsch process development unit, fluid bed gasification plant, CBJ hydraulic press, and high temperature graphitization furnace (up to 2750°C)
- The institute has a wide range of modern instrumental facilities for testing and characterization of materials, particularly coal and related coal-based products. These include:

  Atomic absorption spectrometer, gas chromatograph mass spectrophotometer, FT-NMR/IR spectrometers, surface area analyzer, ESR spectrometer, gas chromatographs, proximate analyzer (automatic), elemental analyzer (automatic), X-ray diffractometer, UV & IR-spectrophotometers, Orthoplan-POL microscope, Haake viscometer, particle size analyzer, semi- automatic image analyzer, high pressure liquid chromatographs, CDS micro reactor, differential scanning calorimeter, mini computer system, high volume air samplers, stack sampler, spectro-calorimeter, water kit analyzer, mercury porosimeter, Zeta potential analyzer, coke reactivity apparatus, automatic Gieseler plastometer, sulphur determinator, thermal analyzer, heating microscope, temperature programmed desorption apparatus, automatic calorimeter, inductively coupled plasma emission spectrometer.

SERVICES OFFERED

CFRI offers services to the coal-based industries by undertaking sponsored projects/feasibility studies and providing expert services in the areas of coal quality assessment, coal beneficiation and preparation, coal carbonization, coal combustion, coal tar chemicals, and waste utilization.

TRAINING COURSES

The laboratory conducts training courses for industry, R&D organizations and educational institutions, in its areas of activity.

PUBLICATIONS

The laboratory publishes a primary journal *Fuel Science & Technology*, CFRI Newsletter and its annual reports.

Contact Person: Director, CFRI

COAL SURVEY LABORATORIES

CFRI Coal Survey Laboratory
Jharia
P.O. FRI, Dhanbad (Bihar)
Telegram: RESEARCH, FRI
Telephone: 61699, 61807 & 61853

CFRI Coal Survey Laboratory
P.O. Namkum
Ranchi (Bihar)
Telegram: COALSURV Telephone: 20348

CFRI Coal Survey Laboratory
17/C Telenkhedi Area
Civil Lines
Nagpur
Telegram: COALSURV Telephone: 31319

CFRI Coal Survey Laboratory
Canal Road
Jammu-Tawi (J&K)
Telegram: COALSURV Telephone: 5912

CFRI Coal Survey Laboratory
P.O. Raniganj, Burdwan (W.B)
Telegram: COALSURV Telephone: 95

CFRI Coal Survey Laboratory
Jorhat (Assam)
Telegram: COALSURV Telephone: 185

CFRI Coal Survey Laboratory
Circuit House Road
Bilaspur (M.P.)
Telegram: COALSURV Telephone: 102

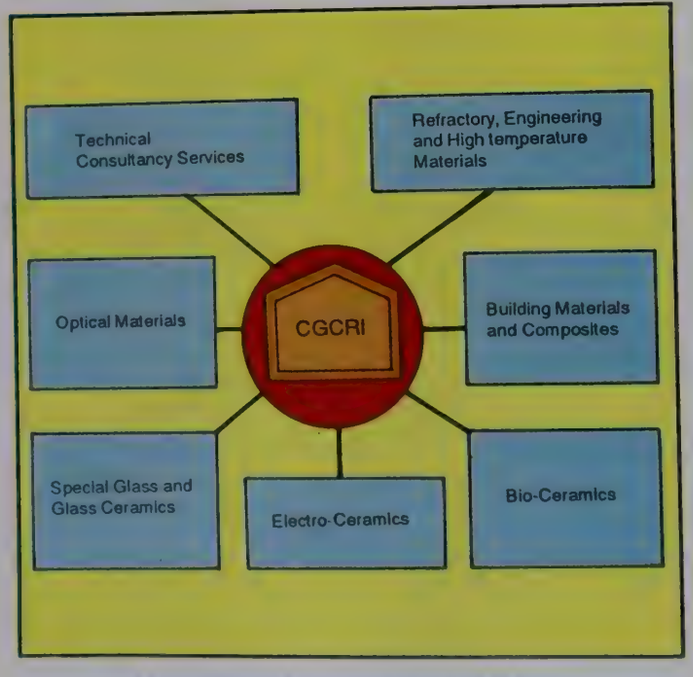
Central Glass & Ceramic Research Institute (CGCRI)

Calcutta 700 032
Telephone: 73-3496, 73-3469, 73-3476 & 73-3477 Telegram: GLASCERCH CALCUTTA
Telex: 021-7787 GANGA IN FAX : 9133-73-1523

Established: 1950
Director: Dr B.K. Sarkar, Ph.D. (Materials Science; London University)
Budget for 1992-93 : Rs 542 lakh (S.E.)

MANDATE

- To carry out fundamental and applied research in fields of glass, ceramics, refractories, vitreous enamels, composites and allied materials
- To develop appropriate technologies relevant to the country's defence, economic, industrial and social needs
- To undertake R&D with a view to helping import substitution and updating imported technologies
- To undertake projects sponsored by private/public sector institutions and to provide technical advisory and infrastructural services like project engineering, testing & evaluation, dissemination of information, etc.



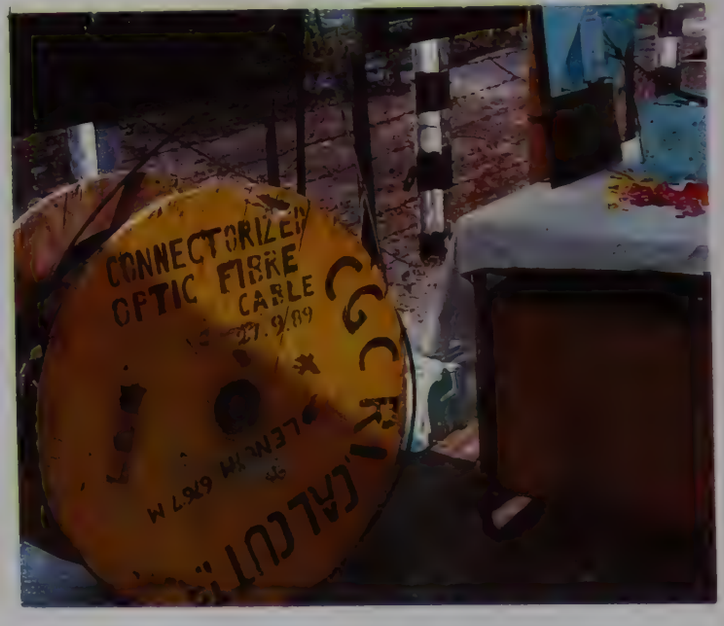
MAJOR R&D PROGRAMMES

The major R&D programmes of CGCRI relate to the development of different varieties of optical glasses, optical materials, electronic materials, engineering and high temperature materials, composites, low-cost building materials and bioceramics. Other major programmes are aimed at conservation of energy, and societal missions.

SIGNIFICANT ACHIEVEMENTS

CGCRI has developed the following products in various areas of its activities:

- Twenty-seven varieties of optical glasses and a few varieties of radiation shielding window glasses for attenuation of high energy radiation in nuclear reactors
- Nd-doped laser glass for use in range finders, silicate laser glass for use in plasma application and laser glass discs and rods conforming to defence requirements
- Graded index multimode fibre as per CCITT specifications and optical fibre for use in radioactive environment
- Anti-reflective and anti-glare coatings on radiation shielding glass window, ophthalmic lens and sheet glass; high-purity silica glass; and zirconia-doped microspheres for plasma spray applications
- Synthetic high alumina aggregates (58-86% Al_2O_3), low-moisture castables (54-75% Al_2O_3), high intensity dolomite sinters, high alumina bricks from sillimanite



Optical fibre cable

beach sand, insulating bricks from rice husk ash, binders from waste red mud, sintered alumina products, high alumina cement (up to 75% Al_2O_3)

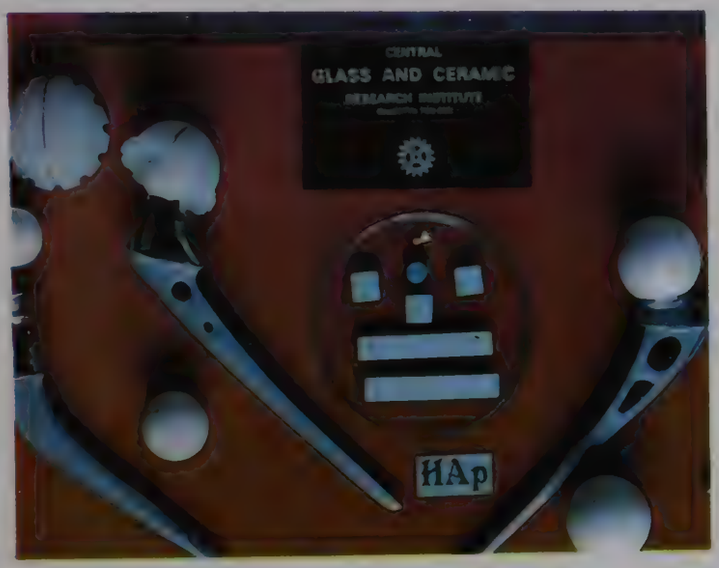
- Low-cost building materials like hollow bricks, glazed tiles and bricks, roofing panels; glass reinforced gypsum composite — a substitute for timber; and Portland cement mixed with industrial and agricultural waste materials

- Silver-doped phosphate (radio photo-luminescent) glass for use as dosimeter, full scale crystal glass and ion selective glass electrodes for measurement of *p*H, *p*Na, *p*K and pCO_2

- Superconducting wires and tapes with Jc value of more than 4000 at liquid N_2 temperature

- Phase-pure fine powders of YBCO superconductor; fine powders of titanates of barium, strontium and lead; flawless synthetic quartz single crystals; and conductive and resistive thick film printing pastes for hybrid circuits

- Reaction-bonded SiC, impervious high strength reaction-bonded SiC tube; silicon nitride and other nitrogen ceramics involving boron, titanium and aluminium; high purity ultrafine active alumina powder; TTAC-TiC composites; yttria doped PSZ ceramic powders; high temperature and high corrosion resistant glass ceramic coating materials



Ceramic implants developed at CGCRI

- Ceramic heads for hemi-hip joining prosthesis

- Energy-efficient shuttle kiln (trolley type furnace) for high temperature application up to 1600°C; and fuel-efficient low thermal mass (LTM) kilns suitable for small scale pottery industry

- A model low-cost building at the institute campus constructed with materials developed at the institute and a model Ceramic Centre for providing training to rural potters at Bankura district of W. Bengal

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

The major technologies already transferred to industry relate to:

Alumina ceramics for electrical and other engineering uses; ceramic colours; cordierite based saggars; cordierite glass- ceramic materials; corrosion and abrasion resistant glass-ceramic tiles from basalt; decolourization of mineral substances such as clays or sand; glass bonded mica; glass-ceramic tiles for abrasion and corrosion resistant applications; glass colour; glass electrodes for *p*H, *p*Na and *p*K measurements; glass reinforced gypsum; glazed wall tiles from common clay; high alumina bricks from sillimanite beach sand; high alumina cement; high density dolomite sinters; high performance kiln car deck slab for pottery industry; high strength plaster of Paris; high temperature protective enamels for jet aero-engine components; heat wheel; inorganic bonded micanite; insulating bricks from rice husk ash; lead-free enamels for wire wound resistors; lead-free white and coloured enamels for aluminium; low-cost technology for production of fibre glass; low moisture castable; low thermal mass kiln; matt glazed tiles for flooring and facing; mica based textured coating; mica insulating bricks; optical communication fibre; optical glass; sintered alumina products; sodium silicate from rice husk ash; sol-gel application of antiglare coatings on ophthalmic lenses; staining composition of glass; synthetic high alumina aggregate; thermal conductivity tester; and water filter candles.

TECHNOLOGIES READY FOR TRANSFER

Technologies for the production of following products are ready for transfer:

Barium titanate; blood capillary *p*H electrodes and pCO_2 electrodes for anaesthesia monitoring equipment; clear silica glass by sol-gel route, crystal glass; crystalline coating for mild steel and stainless steel; glass filters; high purity reactive alumina; jewellery glass; nitride bonded silicon carbide refractories; quality plaster of Paris from phosphogypsum; reaction bonded silicon nitride; sol-gel application of anti-glare coating on sheet glass; sol-gel application of antireflective coatings on ophthalmic and other glasses; synthetic quartz single crystal; and thick film printing ink/paste for electronic industry

MAJOR FUTURE PROGRAMMES

The major future programmes envisaged are: (i) Development of advanced ceramic materials in various sophisticated and emerging areas of application, (ii) development and production of new types of optical glasses mainly for supply to defence, (iii) setting up of a demonstration-cum-production centre on low-cost building materials at Salt Lake, Calcutta, (iv) development of ceramic materials for bio-medical applications, (v) glass-ceramic coating materials for protection of equipment used in power generation and other industrial equipment against corrosion, erosion and high temperature, and (vi) environmental pollution abatement through development of smoke reduction devices in ceramic kilns, honeycomb substrate for catalytic

conversion of auto-emission gases to non-toxic forms, ceramic membranes for ultrafiltration in effluent systems, etc.

In addition, development and upgradation of technologies having societal impact would continue to receive priority. The institute will act as a nodal agency for development and improvement of rural pottery in different states which will lead to quality improvement and employment generation. Work in this direction is likely to be undertaken shortly at Bastar (M.P.) and Bolpur (W.B.).

Rack of grown crystals being taken out of autoclave

MAIN FACILITIES

- A wide range of sophisticated instruments like SEM, X-ray and dilatometer, electron microscope, ESCA/AUGER/SIMS, etc. for testing and characterization of materials
- Furnace for experimental melting and firing of ceramic articles
- Facilities for engineering fabrication and process engineering
- Computer facilities
- A well-equipped workshop to back up R&D work

Control console of the crystal growing unit

SERVICES OFFERED

- Testing of glass and ceramic raw materials & chemical analysis; issue of certificates on such testings
- Technical consultancy to set up industrial production units
- Consultancy in ceramics, glass, refractories, vitreous enamels and composites
- Standardization of the above products as per ISS
- Supply of technical, techno-economic and industrial information/data and photo/xerox copies of documents

TRAINING COURSES

The institute organizes short term specialized practical training courses in the fields of glass, ceramics, refractories, composites, silicate analysis, etc. It also organizes entrepreneurship development training programme in fibre reinforced plastics (FRP).

PUBLICATIONS

The institute publishes the journal *CGCRI Bulletin*, (Quarterly), *Documentation List on Glass & Ceramics* (Monthly), newsletter — *Glance* (Monthly), *Ceramics Update* (Quarterly) and its annual reports.

The institute has also produced four documentary films : (i) *Perfect Precision*, (ii) *Waste to Wealth*, (iii) *The Story of Glass*, and (iv) *Tradition and Innovation*.

Contact Person: Director, CGCRI

FIELD STATIONS

CGCRI Extension Centre,
Naroda Industrial Estate,
Ahmedabad 382 330.

CGCRI Extension Centre,
G.T. Road,
Khurja 203 131.

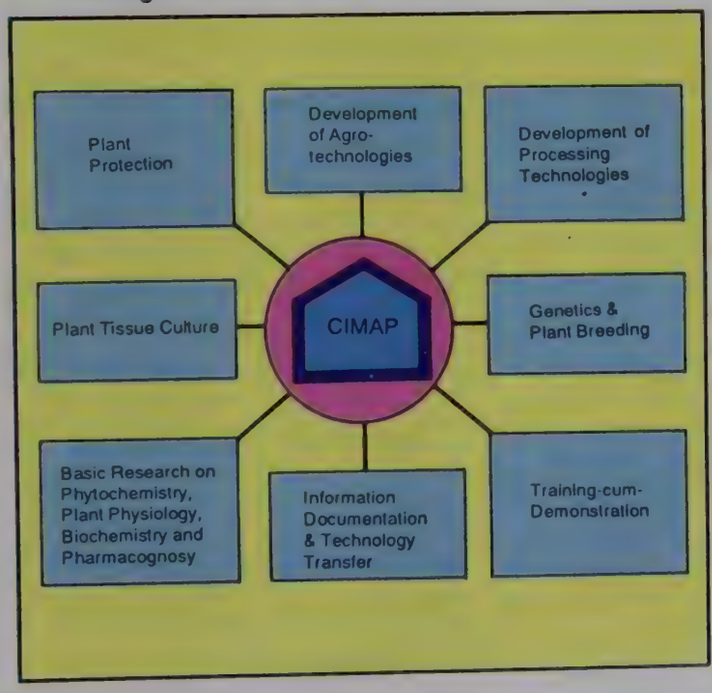
Central Institute of Medicinal and Aromatic Plants (CIMAP)

P.B. No. 1, P.O. RSM Nagar, Lucknow 226 016
Telephone : 71170, 74136, 71568, 74043, 74520 Telegram : MEDPLANTS LUCKNOW
Telex : 0535-298 CIMAP IN FAX : 0522-73654

Established : 1959
Director : Dr Sushil Kumar, M.Sc., Ph.D.
Budget for 1992-93 : Rs 319 lakh

MANDATE

- To pursue developmental and promotional work related to cultivation, production, processing, utilization and marketing of medicinal and aromatic plants and encourage cultivation of medicinal and aromatic plants in suitable regions of the country
- To cultivate medicinal and aromatic plants, either in its own farms or through other agencies, and to process, wherever necessary, the plant materials for obtaining their end products
- To carry out, in collaboration with other agencies, introduction, acclimatization (including measures for prevention and control of pests and diseases) of exotic species and also production of authentic high-yielding seeds, leaves and other propagating materials of medicinal and aromatic plants of economic importance
- To carry out surveys of resources of medicinal and aromatic plants and to maintain economic statistics of the raw materials as well as the finished products
- To act as a 'clearing house' for techno-economic data relating to medicinal and aromatic plants and products derived therefrom and to disseminate information through publication of monographs, brochures, books and all other effective means
- To set up and maintain a specialized herbarium and museum of medicinal and aromatic plants of economic importance as well as products derived therefrom



MAJOR R&D PROGRAMMES

Development of agrotechnologies and chemical and processing technologies for economically important medicinal and aromatic plants, both indigenous and exotic, is an important goal of the institute. Basic research in the area of phytochemistry, plant physiology and biochemistry, pathology, genetics, entomology and pharmacognosy also forms an important and integral part of the overall R&D programme of the institute

SIGNIFICANT ACHIEVEMENTS

- Development of improved agronomic practices including crop improvement for higher yield per unit area of indigenous medicinal and aromatic plants, introduction of exotic medicianl and aromatic plants of commercial importance, development of process

Bulgarian variety of rose introduced in Kashmir Valley

technologies and extension of knowhow among the farmers and entrepreneurs

- Some of the impact making technologies developed by CIMAP are: high-yielding varieties of Japanese mint (MAS-1 and HYB-77), spearmint (MSS-1 and MSS-5), Scotch spearmint (MCAS-2), Bergamot mint (Kiran), Hill mint (Supriya), Palmarosa (PRC-1 and Trishna), citronella Java (B10-13, Manjusha and Mandakini), lemongrass (Pragati, Praman and Cauvery), Vetiver (KS-1, KS-2 and Sugandha), lavender (Sher-E-Kashmir), rose (Noorjehan), and introduction of Bulgarian rose in Kashmir Valley, development of knowhow for menthol crystallization and fractionation of DMO for value-added products, development of a modern distillation plant for rose oil and improved field distillation unit for essential oils. The menthol-rich varieties of Japanese mint (MAS-1 and HYB-77) have revolutionized the menthol industry in India by increasing the production of oil from about 400 tonnes in 1982-83 to about 2000 tonnes during the year 1990-91, valued at about 40 crores of rupees. Now, India exports mint oil and menthol to the tune of more than 7 crores of rupees per month. Similarly, due to development and release of HYVs spearmint, country has become self-sufficient in this oil also. The citronella Java plant was introduced by CIMAP in 1962-63,

Ergot of rye

and its agrotechnology developed in collaboration with RRL, Jorhat. About 600 tonnes of citronella Java oil valued at Rs 8 crore is now produced annually making the country self-sufficient in this commodity.

- Technology for the production of rye-ergot developed by CIMAP and transferred to industries for commercial exploitation has made the country self-sufficient in this crop.
- Pyrethrum, source of natural and safe insecticide, is being produced in the country based on the technology developed by CIMAP. A superior strain (SPS-387), which gives higher flower yield is resistant to frost and pests, has also been developed.
- A rose oil pilot plant installed in Aligarh district has led to higher oil recovery as compared to that obtained using countrymade stills.
- CIMAP has introduced a Chinese antimalarial drug plant *Artemisia annua* and developed the necessary agrotechnology for its cultivation and process technology for the production of artemisinin, the major constituent, and preparation of arteether from artemisinin.
- As a result of transfer of technologies to the private and public sectors, the country produced essential oils and medicinal plants worth over 260 crores of rupees

Plant for rose oil extraction developed at CIMAP

and saved an equal amount as foreign exchange during the last decade.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Cultivation of medicinal and aromatic plants such as mints, aromatic grasses, lavender, geranium, pyrethrum, ergot, belladonna, davana, linaloe, Bulgarian coriander, etc.
- Menthol crystallization and DMO processing
- Pyrethrum oleoresin from pyrethrum flowers
- Colchicine from *Gloriosa superba*
- Ajmalicine from *Catharanthus* roots
- Rose oil from rose flowers
- Nagarmotha oil from *Cyperus scariosus*
- Improved technology for distillation of essential oils

TECHNOLOIGES READY FOR TRANSFER

- Diosgenin from rhizomes of *Dioscorea deltoidea*
- Hyoscine and hyoscyamine from *Duboisia* and *Hyoscyamus* spp.
- Berberine hydrochloride from *Berberis* spp.
- Total alkaloids from *Catharanthus* roots
- Geraniol and citronellol from Java citronella oil

- Geraniol from palmarosa oil
- Linalool and linalyl acetate from *Mentha citrata* oil
- Citral from lemongrass oil
- Cedarwood oil from *Cedrus deodara*
- Vetiver oil from vetiver roots
- Celery seed oil from celery seeds
- Plant design for rose oil
- Improved process for the isolation of artemisinin from *Artemisia annua*
- Mass propagation (tissue culture) of medicinal and aromatic plants
- Jasmine concrete and absolute from Jasmine flowers
- Tuberose concrete and absolute from tuberose flowers

MAJOR FUTURE PROGRAMMES

The major future programmes of CIMAP will relate to development of improved varieties of medicinal and aromatic plants using both classical genetics and tissue culture methods. Efficient utilization of culturable wasteland, marginal and drylands through development of appropriate technologies and improved varieties would be undertaken. Introduction of medicinal and aromatic plants in Andaman & Nicobar islands and in temperate areas of Uttar Pradesh has been planned.

Arteether, a derivative of artemisinin, would be made available for commercial exploitation after completion of satisfactory clinical trials. Plant molecular studies would be initiated. Production of secondary metabolites such as ginsenosides, etc., would be undertaken. More efforts would be made to popularize CIMAP's technologies through training-cum-demonstration programmes throughout the country.

MAIN FACILITIES

- Modern instrumental facilities needed for biological and chemical research, e.g., atomic absorption spectrophotometer, infrared spectrophotometer, ultraviolet spectrophotometer, HPLC, FT-NMR, gas liquid chromatograph, transmission electron microscope with scanning attachment, Vickers cytophotometer and GC-mass spectrometer
- Survey, identification and chemical screening of medicinal and aromatic plants
- Research farms for conducting R&D trials under various agroclimatic conditions (CIMAP Headquarters and Regional Centres)
- Workshop and Pilot Plants
- Computerized Data Processing Unit
- Library and Reprography Unit

SERVICES OFFERED

The institute offers consultancy/technical services for cultivation and distillation/extraction of medicinal and aromatic plants. Testing and anlaysis of crude drugs and essential oils is carried out and assistance is provided to growers in marketing their products. The institute undertakes survey of land for cultivation and preparation of feasibility reports, supply of planting materials, supply of engineering designs for pilot- plant, improved field distillation unit, etc.

TRAINING COURSES

Training programmes in the area of medicinal and aromatic plants are arranged for growers, entrepreneurs and researchers at regular intervals.

PUBLICATIONS

CIMAP brings out Farm Bulletins, an abstracting journal *Current Research on Medicinal and Aromatic Plants* (CROMAP) (Quarterly), *CIMAP Newsletter* (Quarterly), and its annual reports.

The institute has brought out a number of monographs, such as *Major Essential Oil-bearing Plants of India* (1988), *Major Medicinal Plants of India* (1992), *Dictionary of Indian Medicinal Plants* (1992), *The Opium Poppy* (1983), *Directory of Crude Drugs and Aromatic Plants Dealers, Producers and Exporters in India* (revised Ed. 1992), *Proceedings of the International Symposium on Medicinal and Aromatic Plants* (26-28 Dec. 1983), *Tissue Culture and Biotechnology of Medicinal and Aromatic Plants*, etc.

Contact Person: Director, CIMAP

FIELD STATIONS

CIMAP Regional Centre
P.O. Dairy Farm
Nagla 263 143
Dist. Nainital (U.P.).

CIMAP Regional Centre
Allalsandra Near Yelahanka
GKVK P.O.
Bangalore 560 065
(Karnataka)

CIMAP Regional Centre
Boduppal, Uppal Road
Hyderabad 500 039 (A.P.)

CIMAP Regional Centre
Attuvampatti, P.B. No. 22
Kodaikanal 624 101 (T.N.)

CIMAP Regional Centre
Coorg, Mysore (Karnataka)

CIMAP Regional Centre
Bonera
Dist. Pulwama 192 301
Kashmir (J&K)

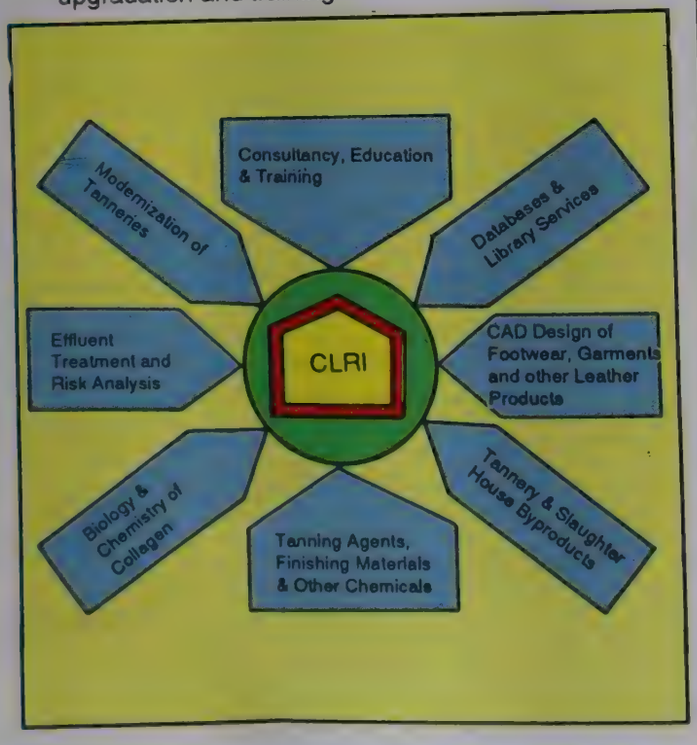
Central Leather Research Institute (CLRI)

Adyar, Madras 600 020
Telephone : 412616, 412150, 410897 Telegram: LESERCH, MADRAS
Telex : 041-21041 CLRI IN FAX : (91) 044-411589 E.Mail : clri@ sirnetm.iitm.ernet.in

Established: 1953
Director: Dr G. Thyagarajan, Ph.D., FRSC, FIC
Budget for 1992-93: Rs 617 lakh

MANDATE

- To seek excellence in research in biological, chemical and engineering sciences
- To serve as the national apex research institution in the areas of leather and related products
- To provide education and training in leather and allied sciences on national and international levels
- To help in technology planning and forecasting
- To render technical assistance to leather industry
- To serve as a technology gatekeeper and information base in leather sector
- To develop and deliver technologies to the industry through effective extension network
- To assist other developing countries in technology upgradation and training


Consultancy, Education & Training
Modernization of Tanneries
Databases & Library Services
Effluent Treatment and Risk Analysis
CLRI
CAD Design of Footwear, Garments and other Leather Products
Biology & Chemistry of Collagen
Tanning Agents, Finishing Materials & Other Chemicals
Tannery & Slaughter House Byproducts

MAJOR R & D PROGRAMMES

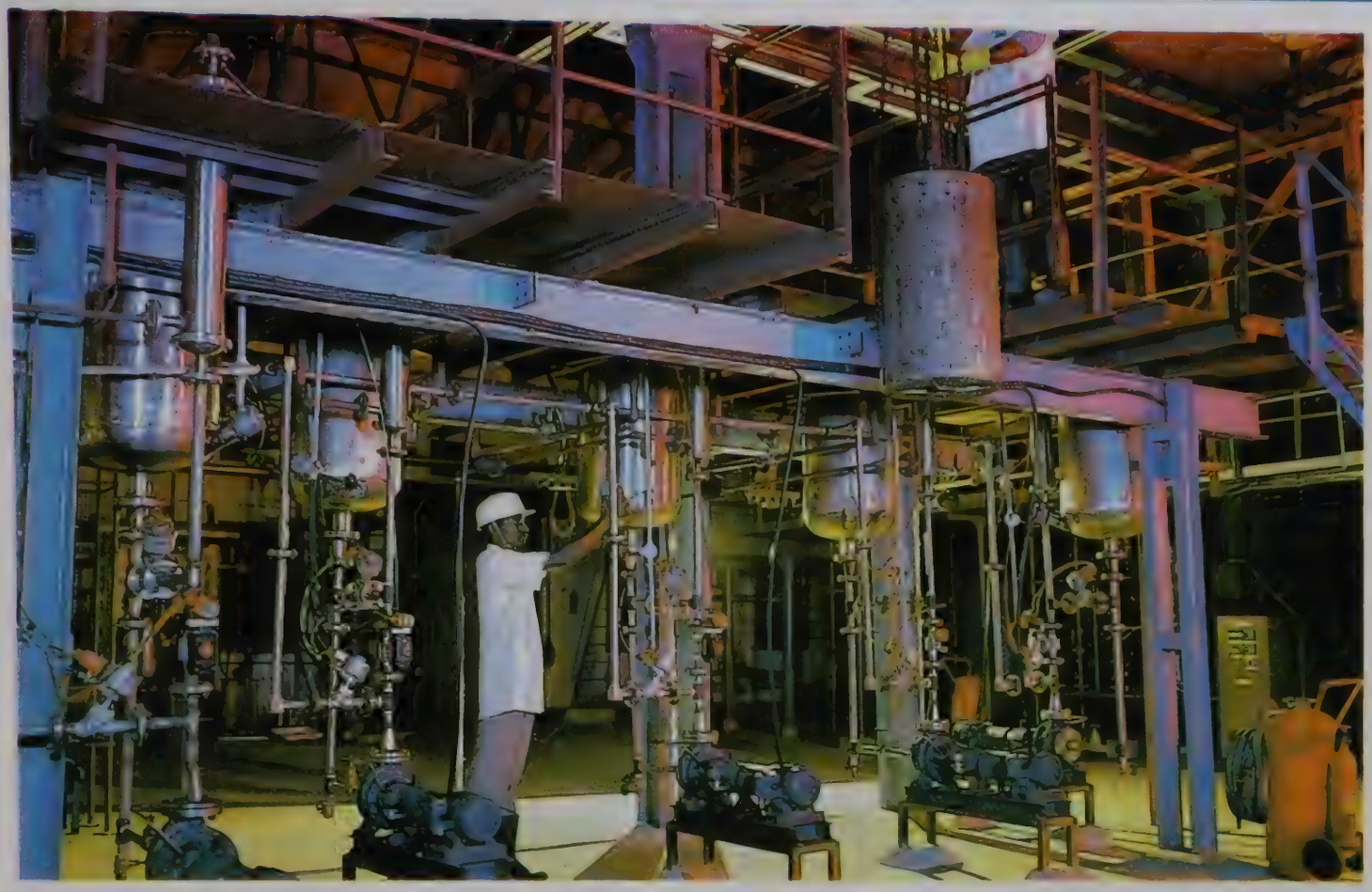
The major R&D programmes of CLRI relate to modernisation of tanneries, development of environment-friendly chemicals and technologies including enzymatic options, computer-aided designs for footwear and garments, split leathers and quality upgradation of lower ends, molecular biology of collagen and metal-collagen interactions, waste water management, region-specific appropriate technologies, tannery and slaughter house byproducts including carcass utilization, and hazard & risk analysis.

SIGNIFICANT ACHIEVEMENTS

- Basic research contributions relating to combination tanning mechanisms, mechanism of shrinkage phenomena, aluminium and zirconium tanning materials, structural aspects of collagen, nutritional disorders and collagen, structural stability of chrome-collagen compounds, Indian vegetable tannin resources, novel NMR techniques and chemistry of chromium and its complexes.
- Applied research relating to new and innovative technique for leather processing, upgradation of low grade raw materials and leathers, technologies for manufacture of chemical auxiliaries, animal and tannery byproduct utilization, biotechnologies for leather processing, chrome recovery and reuse, modernization of tannery wet operations, high performance and environment- friendly synthetic tanning agents, nationwide surveys on (a) raw hides and skins, (b) capacity utilization in tanneries and (c) women's employment in footwear sector, and surgical sutures and collagen sheet for burn management.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- High performance tanning compounds Alutan & Alcrotan (Balmer Lawrie & Co., Madras)
- Comprehensive microprocessor based technology package for modernisation of tannery operations (M.A. Khizar Hussain & Sons, Ranipet, Tamilnadu)
- Technologies for synthetic fatliquors (Balmer Lawrie & Co. Ltd, Madras)



Microprocessor - assisted pilot plant for blended vegetable tannin extracts

- Process knownow package for phosphorylated fatliquors (Balmer Lawrie & Co., Madras)
- Technology on microprocessor-controlled blended-vegetable tannin extracts
- Knowhow package for development of rice bran oil wax products for leather industry (Yanam Oils Ltd, Kakinada)
- Process knowhow package on trimethoxybenzoic acid (Silver Hills Private Ltd, Attur, Tamilnadu)
- Process knowhow package on Thiram & Ziram (M/s SPIC, Madras)
- Upflow anerobic sludge blanket (UASB) reactor for tannery effluent treatment at Kanpur (under Indo-Dutch programme)
- Development of high quality shark leathers (Bay of Bengal Fisheries Development Programme).
- Technology on keratin hydrolysate (retanning and filling agent) (Protochem Industries, Pondicherry)
- Risk assessment studies (Visakhapatnam Steel Plant, Tamilnadu, Fluorine & Allied Chemicals, Madras Port Trust, and Proctor and Gamble (India) Ltd.)

TECHNOLOGIES READY FOR TRANSFER

- Newer techniques for processing and finishing of buffalo splits and lower ends of leather into utility/speciality leathers
- Gait analysis and CAD (computer aided design) based footwear designs

Design of footwear through computer-aided techniques

- Insole board for footwear
- High exhaust tanning salts
- Syntans and fatliquors
- Knowhow on Claribleach for bleaching of human hair
- Meat, poultry feather and carcass meal

MAJOR FUTURE PROGRAMMES

Greater attention would be paid to quality improvement of raw hides and skins; process optimization and control in various tannery operations; zero or low waste technologies; aqueous finishing and topcoat agents; design and fabrication technologies for leather products; value-added products from slaughter house & tannery wastes, and objective assessment of leather.

FACILITIES AVAILABLE AT CLRI

- Pilot tannery
- Footwear pilot plant
- Chemical pilot plant

Wet processing in a modernized tannery

- Design cell
- Polymer - testing & synthesis
- Byproducts pilot plant
- NICLAI - National Information Centre on Leather and Allied Industries.

SERVICES OFFERED

CLRI offers comprehensive services in setting up and promoting leather processing units. Expertise and experience exist in development of technology packages for specific clients for establishing tanneries, leather chemical units, effluent treatment plants and leather products manufacturing units. CLRI also undertakes safety and risk analysis studies for various industries.

TRAINING COURSES

CLRI, in association with Anna University, Madras, offers B. Tech & M. Tech. (Leather), M. Tech. (Footwear Science and Engineering) and Ph.D. in leather technology and in basic sciences.

CLRI has also been serving as an international training centre for leather and leather products sectors for candidates sponsored by FAO, UNIDO, UNDP, CSC, ITC, etc.

To meet the acute shortage of qualified personnel in various sectors of the leather industry, CLRI offers several specialized training programmes on regular basis in the following areas: leather processing, chemicals, footwear, leather goods and byproducts.

PUBLICATIONS

The laboratory publishes *LESA* (Leather Sciences Abstracts) (monthly) and its annual reports.

Contact Person : Director, CLRI

FIELD STATIONS

Regional Centre for Extension & Development (CLRI)
220, Dharavi Road, Bombay 400 017.
Phone: 403770

Regional Centre for Extension & Development (CLRI)
3/1C Matheswartola Road, Calcutta 700 046.
Telephone : 446046, 442381

Fourier transform nuclear magnetic resonance spectrometer

Regional Centre for Extension & Development (CLRI)
11/208 'Souterganj', Kanpur 208 001
Telephone : 290179

Regional Centre for Extension & Development (CLRI)
Nakodar Road, Jallandhar 144 003.
Telephone : 74837

Regional Centre for Extension & Development (CLRI)
C/o Central Modern Tannery, Opp. City Station,
Rajkot 360 003.
Telephone : 24438

(Very soon to be shifted to Ahmedabad at the following address:
5013, GIDC, 4th Phase,
Vatwa New Telecon Retail Store
Ahmedabad 382 445
Telephone : 830352

Central Mechanical Engineering Research Institute (CMERI)

Durgapur 713 209
Telephone : 2149, 2261-62-63(PBX) Telegram : MECHSEARCH, DURGAPUR
Telex : DGP. 213

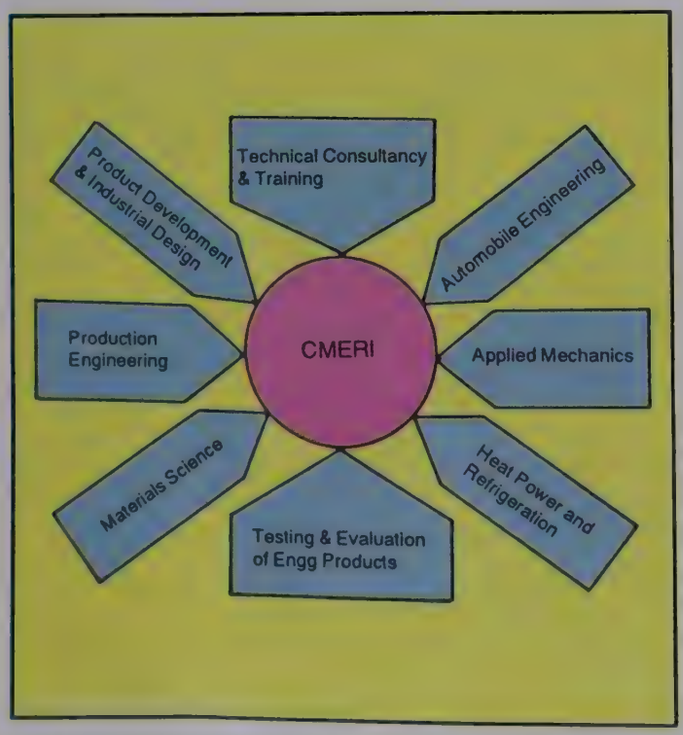
Established: 1958
Director : Dr A. Gopalakrishnan, Ph.D. (Nucl. Engg.; California)
Budget for 1992-93 : Rs 308 lakh

MANDATE

- To conduct research in different areas of mechanical engineering
- To develop new technologies/products/processes suited to the needs of the country
- To develop technologies in emerging hi-tech areas with a view to providing import substitution
- To assist the industries (large, medium and small scale) through consultancy, training, etc.

MAJOR R&D PROGRAMMES

The major R&D programmes of CMERI relate to design



and development of mobile manipulators, robotics, deep-seabed mining systems, modern oil expellers, reliability analysis of systems in atomic power plants, automated power looms and sugarcane harvesters.

SIGNIFICANT ACHIEVEMENTS

- CMERI has successfully designed and developed a stepper motor- driven microprocessor-controlled Automated Guided Vehicle (AGV) for application in strategic and safety related areas as well as in routine material handling applications in manufacturing units.

Sea-bed mining vehicle

- In the area of cutting tools, the institute has successfully developed high performance ceramic cutting tools of zirconia toughened alumina (ZTA) for moderately low and very high cutting speeds.
- Keyless lock assembly, a compact device for transmission of constant torque, is an example of some of the innovative products developed by CMERI over the years.
- To prevent loss of potency of immunization vaccines during storage, the institute has designed and developed a walk-in refrigerator-cum-refreezer.
- A hydraulic knap-sack power sprayer (atomization type) has been designed to eradicate pests and pathogens that threaten crops.

- A cost-effective reverse osmosis plant has been designed and developed by CMERI for removal of brackishness of drinking water.
- The institute has developed an indigenous epoxy concrete technology to replace conventional cast iron machine structures and machine elements.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Zirconia toughened alumina (ZTA)
- Ceramic cutting inserts
- 10/12 h.p. Power tiller
- Friction welding machine
- Brick moulding machine
- Note shredding machine
- Electric cloth-cutting machine

TECHNOLOGIES READY FOR TRANSFER

- Epoxy concrete
- Vaccine cooler
- Low h.p . tractor

Power tiller (12 hp) developed at CMERI

- Keyless lock assembly
- Harmonic drive wave generator

MAJOR FUTURE PROGRAMMES

The future programmes of CMERI will be directed towards development of (i) critical spare parts as import substitutes, (ii) commercially viable deep-seabed mining systems, (iii) high capacity oil expellers and (iv) products for small scale industries.

MAIN FACILITIES

- A wide range of modern instruments for carrying out non- destructive and metallurgical testing, etc.
- Modern workshop facilities
- Computer facilities
- Library
- PCB making equipment

SERVICES OFFERED

CMERI offers consultancy services to industry, R&D units and several public sector engineering companies, and undertakes contract research on specific problems and requirements of industry. The institute also provides analytical and testing services to the industry.

TRAINING COURSES

CMERI conducts training courses for industry, R&D organizations and educational institutions, in the area of mechanical engineering.

PUBLICATIONS

The institute publishes *Mechanical Engineering Bulletin* (quarterly), and its annual reports.

Contact Person: Director, CMERI

FIELD STATIONS

MERADO
NCL Campus
Pune 411008
Telegram: MERADO

MERADO
CSIR Cochin Complex
Kalamassery 683 109
Telegram: CONSEARCH

MERADO
CSIR Madras Complex
PO TTTI Taramani
Madras 600 113
Telegram: CONSEARCH

MERADO
Gill Road
Ludhiana 141 006
Telegram: MERADO

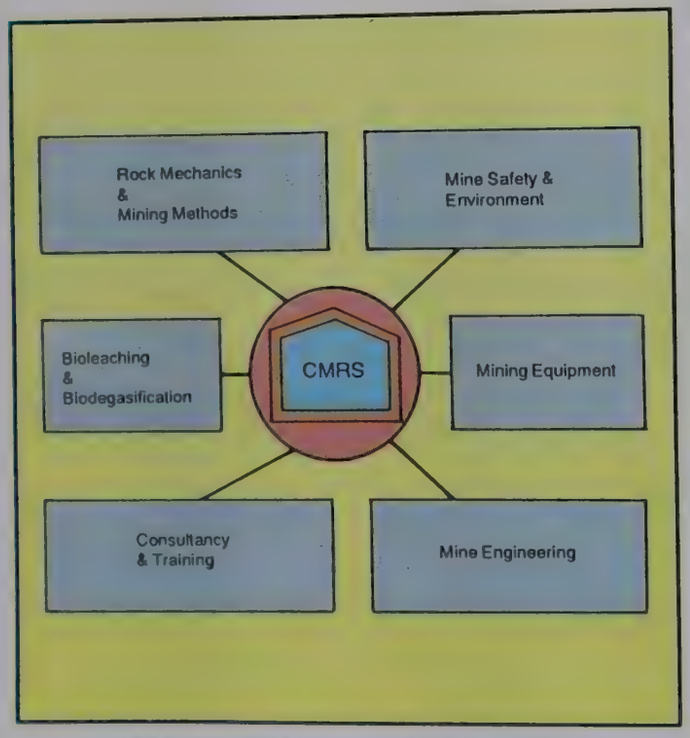
Central Mining Research Station (CMRS)

Dhanbad 826 001
Telephone:(0091)(0326)822156,5911 Telegram : MINSEARCH, DHANBAD
Telex : 0629-208 CMRS IN FAX : (91) (326) 822214/822183

Established: 1955
Director : Prof. Bharat B. Dhar, Ph.D. (McGill, Canada)
Budget for 1992-93 : Rs 457 lakh

MANDATE

- To carry out R&D work in the field of rock mechanics and mining methods
- To develop machinery and equipment/instruments with a view to increasing mining safety, productivity and economy
- To find ways of reducing environmental pollution owing to mining, and health hazards to miners



MAJOR R&D PROGRAMMES

The major R&D programmes of CMRS pertain to development of: mining technology for the exploitation of complex coal deposits; total packages for optimal exploitation of mineral deposits using improved technologies; numerical modelling of rock excavations and computer application in mine planning and designing from stability and safety points of view; and underground space technology. In addition, work has been done on prediction of ground stability; parameters contributing to air pollution in mines; ergonomics in mining operations; corrosion in mines; physical modelling of coal mining systems; development of communication systems for mines, methods for ventilation and safety in mines, mining machinery and equipment as well as methods for reclamation of mined areas.

Testing for reliability study of hydraulic prop

SIGNIFICANT ACHIEVEMENTS

- Techniques of pillar design for the recovery of otherwise difficult to extract coal, which have been accepted by the Directorate General of Mines Safety (DGMS) for implementation in Indian coal mines
- CMRS work on longwall mining has helped in successful adaptation of mechanized longwall system over diverse geomining conditions

- Modification, improvement and adaptation of various new technologies such as narrow panel system of mining, wide stall mining, inclined slicing with mixed support, etc., have enabled extraction of coal under complex mining conditions, e.g., underneath surface structure and water bodies
- Formulation of norms for prediction and control of subsidence has helped the mining industry to extract coal underneath and in the vicinity of surface features and structures, railway lines, water bodies, etc.
- Development of methodologies for blind backfilling of unapproachable underground workings
- Modification of stowing plants for coal mining and of the method of backfill in metal mines has improved the mineral productivity
- Improvement in technology of ventilation network planning and utilization of the techniques of pressure balancing have enabled reopening of mines closed due to risk of fire
- Design and stabilization of tunnels, roadways, hydraulic dams and underground structures under difficult geomining conditions
- Monitoring and control of blasting, biodegasification and bioleaching, fire hazard and its control, air and water pollution assessment and its control
- Technologies developed for developing nations : Environmental management of mining operations; testing facilities for mining and allied equipment; ventilation network planning of underground excavations
- Construction of a model low-cost house for slum dwellers
- Mine subsidence prediction, control and analysis
- Numerical and physical modelling
- Stabilization and rehabilitation of old mine workings

Monitoring of the stability of a tunnel

- Design, development and monitoring of blasting operations, vibration monitoring and control
- Biodegasification and bio-leaching
- Fire hazard evaluation and control
- Assessment, design and development of pollution control measures in mines and mining areas
- Reclamation and management of mine waste dumps
- Ventilation network planning and design
- Design and development of mine safety equipment
- Testing/analysis/evaluation/standardization including calibration of mining equipment, explosives, coal/rock samples, mine environment and ventilation instruments, flame-proof equipment, safety equipment, and materials

TECHNOLOGIES TRANSFERRED

Technologies Relating to Coal Mining: Bharat Coking Coal Ltd, Central Coalfields Ltd, Eastern Coalfields Ltd, Western Coalfields Ltd, Northern Coalfields Ltd, North-Eastern Coal-fields Ltd, South-Eastern Coalfields Ltd, The Singareni Collieries Co. Ltd, Central Mine Planning and Design Institute Ltd, Indian Iron & Steel Co. Ltd, Mining and Allied Machinery Corporation, and Tata Iron & Steel Co. Ltd.

Technologies Relating to Non-Coal Mining : Hindustan Zinc Ltd, National Mineral Development Corporation Ltd, Steel Authority of India Ltd, Bharat Gold Mines & Hutti Gold Mines, Uranium Corporation of India Ltd, Hindustan Copper Ltd, Manganese Ore India Ltd, Tata Iron & Steel Co. Ltd, and Pyrites, Phosphates & Chemicals Ltd.

Technologies Relating to Hydel Projects & Tunnels: State Electricity Boards of Kerala, H.P., and Tamil Nadu, State Irrigation Departments of Karnataka, Maharashtra, U.P., Orissa, H.P. and Punjab, Sardar Sarovar Narmada Nigam Ltd (Gujarat), Kumaun Mandal Vikas Nigam (U.P.), Tehri Dam Hydel Division (U.P.), National Hydel Power Corporation, National Thermal Power Corporation, North-Eastern Electric Power Corporation (Meghalaya), J&K State Power Department, Karnataka and H.P. Power Corporations.

Other Miscellaneous Technologies: Indian Railways, Ministry of Defence, Damodar Valley Corporation, Cement Corporation of India, Indian Space Research Organisation, Fertilizer Factories, Port Trust (Calcutta), Oil Corporation, Oil and Natural Gas Commission, and Indian Navy.

MAJOR FUTURE PROGRAMMES

The present activities will be further strengthened with focus on development of cost-effective technologies with the help of greater mechanization.

MAIN FACILITIES

- Testing of materials for their chemical components and physical and mechanical parameters; testing of

wire rope, cage and suspension gear components and other mining machine parts

- Compositional analysis of coal, and ores and minerals of various types
- Testing of electrical equipment used in mines, petrochemical and fertilizer industry with regard to their flame and weather proofness; testing of flammability of various products used in mines
- Certification and testing of explosives and accessories for use in underground mines

Experimental set-up for measurement of tensile and tear strength of flexible ventilation duct fabric

- Testing of physico-mechanical properties of rock and coal samples
- Facilities for computer modelling
- Database on information relating to the country's mineral resources and mining industry

SERVICES OFFERED

CMRS offers contract research, consultancy and technical services in the following areas:

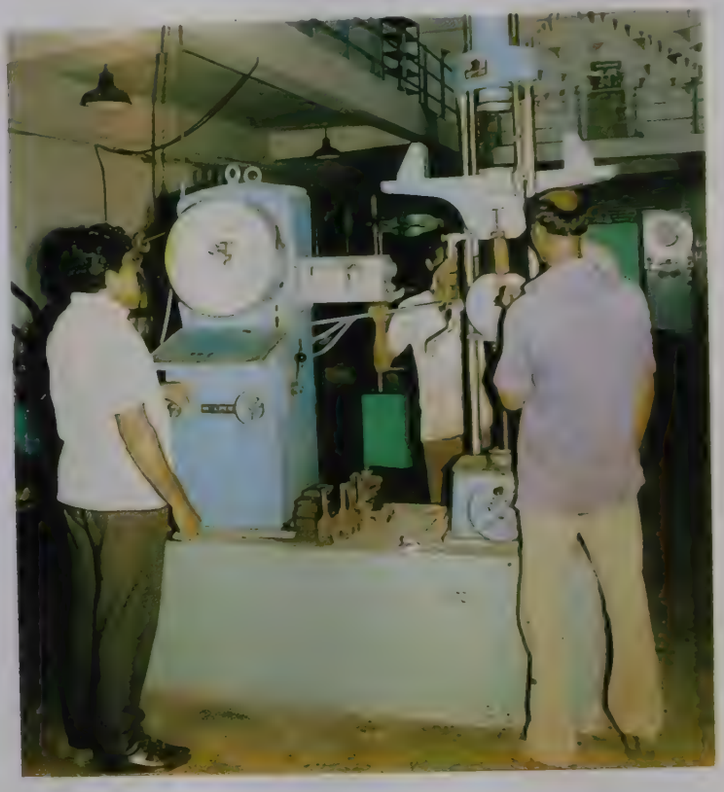
- Stability analysis and design of coal and metal mines; tunnels, dams and underground covering
- Design and development of mine support systems

TRAINING COURSES

CMRS conducts training courses for the benefit of user agencies in its areas of specialization.

PUBLICATIONS

Journal of Mining Research (Quarterly), *CMRS Newsletter*



Tensile test of individual wires in 5 tonnes universal testing machine

(once in four months), annual reports and technical reports.

Contact Person: Director, CMRS.

FIELD STATIONS

CMRS Unit
Ag-4 Indraneel Apartment
Rahate Colony
Wardha Road,
Nagpur 440 022

CMRS Unit
Central Building Rsearch Institute
Roorkee 247 667

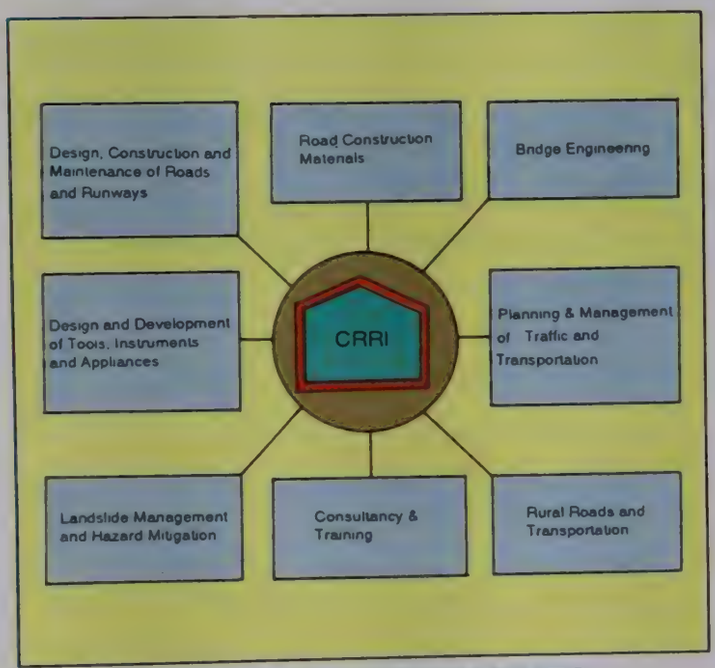
Central Road Research Institute (CRRI)

P.O. CRRI, New Delhi 110 020
Telephone:6848914 Telegram: ROADSEARCH NEW DELHI
Telex: 031-75369 CRRI IN FAX: 00-91-011-6845943
E.Mail: crri@sirnetd.ernet.in

Established: 1952
Director: Dr D.V. Singh, B.E. (Mech), B.E. (Civil), M.S., Ph.D.
Budget for 1992-93: Rs 370 lakh

MANDATE

- To conduct basic and applied research in important areas of highway engineering and allied subjects
- To provide knowhow for the construction of cost-effective, durable and safer roads
- To evolve improved, rational and economical methods of design, construction and maintenance of roads, embankments, runways and bridges
- To develop new tools, instruments and appliances relevant to indigenous/international highway practices
- To assist the highway user agencies through consultancy, contract research, training, etc.


Design, Construction and Maintenance of Roads and Runways
Road Construction Materials
Bridge Engineering
Design and Development of Tools, Instruments and Appliances
CRRI
Planning & Management of Traffic and Transportation
Landslide Management and Hazard Mitigation
Consultancy & Training
Rural Roads and Transportation

MAJOR R&D PROGRAMMES

The major R&D programmes of the institute relate to pavement design and performance, road condition monitoring, pavement management system, maintenance planning and management, pavement deterioration modelling, landslide management and hazard mitigation, and improved transportation planning for emerging urban needs. Besides, applied research on planning and engineering aspects of rural roads, material characterization, pavement evaluation, highway instrumentation, deterioration and rehabilitation of bridges, transportation planning, traffic engineering, road safety and environmental problems forms an integral part of the overall R&D programme of the institute.

Stress analysis in pavements by surface wave technology

SIGNIFICANT ACHIEVEMENTS

- The institute has completed a study, 'Road User Cost Study in India', which makes available, for the first time, data on the effects of road conditions on the

vehicle operation cost and safety. Other significant contributions in road planning include: a study on traffic simulation modelling for inter-urban road sections, a planning model for rural road network, assessment of socio-economic impact of rural roads on the basis of 9 district- level studies, and a study on the future needs of road technology.

- CRRI has developed many new techniques for road construction, specially for stabilized soil rural roads, mechanically stabilized soil sub-base and thin sand asphalt surfacing. Other techniques developed pertain to strengthening and rehabilitation of existing thin cement concrete pavements, which show signs of distress, by providing suitable flexible and rigid overlays.
- CRRI has developed and propagated a number of techniques for stabilizing different types of soil occurring in the country, which have enabled construction of low-cost rural roads. For the location of hidden deposits of low-grade aggregates, the techniques of air photo interpretation have been perfected at the institute.
- The institute pioneered a number of control techniques and preventive measures to avert landslides. Notable among these are the techniques of horizontal drilling to provide drains for quick ingress of water, spreading coir netting to promote vegetation on the hill slopes, geogrids to control rock falls and geotextiles to stabilize subgrade. Techniques like stone columns, lime columns lime slurry injection and geotextiles have been used to improve the strength and load bearing capacity of weak strata in many situations.
- The institute has developed the use of burnt clay pozzolana and lime-pozzolana mixtures for partial replacement of cement, low temperature tar as road binder, improved bituminous materials and mixes with polymer additives, fibre reinforcement, anti-oxidant and rejuvenating agents and durable bitumastic compounds for the paving of bridge decks.
- Various useful techniques for cement road construction, i.e., lean cement concrete, lime-flyash concrete, brick sandwiched concrete pavements, composite rigid pavement and roller compacted concrete pavement have been developed. Rapid repair materials such as epoxy resins and magnesium phosphate cement have been developed for quick repair of distressed cement concrete pavements.
- A new paving system comprising hollow precast concrete blocks with interconnecting dowels has been developed for desert areas. A few stretches are already in service in Rajasthan.
- To measure riding quality of road surfaces, CRRI has developed and patented a range of road roughness measuring devices, viz., profilograph, unevenness indicator, automatic road unevenness recorder and microprocessor-based axle mounted system.
- Studies have been carried out on the road system for Bombay Metropolitan Region for the year 2001, traffic and transportation flows and mobility levels in some selected cities and initial highway capacity norms for Indian conditions. Comprehensive studies have also been undertaken for urban transportation planning in the case of metropolitan and other cities in the country.
- Investigations have been made to identify the sources of pollution and hazards and cost-effective remedial measures have been suggested.
- The institute has contributed significantly in evolving better designs and formulation of codes of practices for expansion joints, wearing courses and bearings for the bridge decks. A technique for measuring deformation during the load test of bridges has also been developed.

MAJOR TECHNOLOGIES TRANSFERRED

- Automatic road unevenness recorder (all PWDs — State & Central, BRO, Municipal Corpns)
- Design of improved bullock carts (village panchayats)
- Design of pavements for special conditions and their strengthening
- Specifications for elastomeric bearings for bridges
- Landslide correction measures
- Urban transport planning for large and medium sized cities

TECHNOLOGIES READY FOR TRANSFER

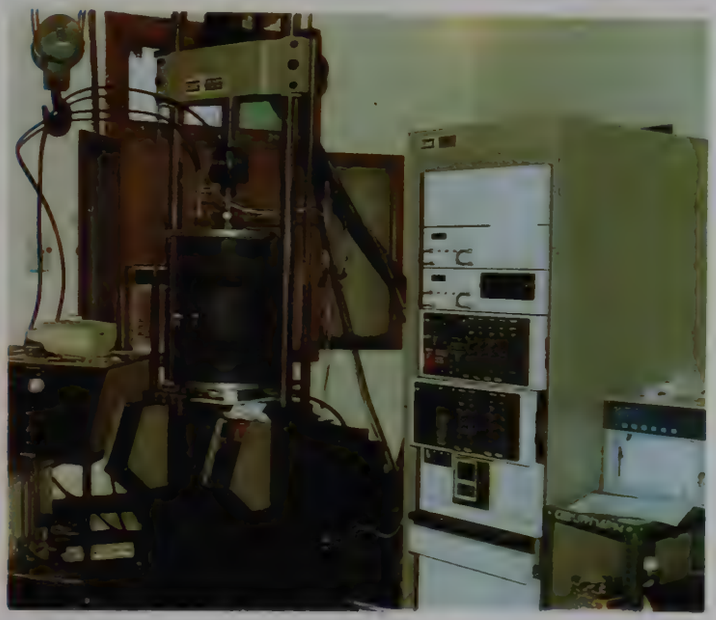
- Landslide control and mitigation (deep-drainage techniques)
- Reinforced composite stone columns (for improvement of soft ground)
- Modified binder and low quality aggregates for improved road construction
- Epoxy bonded plates for flexural strength of beams
- Expansion joints for road bridges
- Paving for special areas like ports, container terminals, snow bound regions, etc.
- Process for the preparation of magnesium phosphate cement for speedy repair of runways
- Process for stabilization of sands with magnesium oxychloride cement
- Devices for measurement of settlement, lateral movements, porewater pressure, heave, etc.
- Vertical profile meter (to measure vertical gradient of roads)
- Driver reflexes test systems (to test psycho-physical traits of drivers)

FUTURE PROGRAMMES

The future programmes of CRRI will be directed towards achieving safe and speedy road transportation with minimal total transportation cost per unit of transportation. A multi-faceted approach has thus been adopted with major emphasis on system development, materials improvement and characterization, upgradation of technology for ground improvement and slope stability enhancement, pavement evaluation, effective maintenance monitoring and software development.

MAIN FACILITIES

- A wide range of modern instruments for pavement evaluation and measuring skid resistance
- Weigh-in-motion system for determination of axle loads of vehicles
- Computer-aided triaxial testing of soils and other granular materials



MTS repetitive triaxial equipment for material characterization

- Fourier transform infrared spectrophotometer (FTIR) for analysis and characterization of materials
- MTS repetitive triaxial shear test equipment for material characterization
- Walk-in environment test chamber for testing the durability of cement concrete and other building materials
- Heavy duty pulsator for repetitive loading of different intensities and frequencies for testing of structures and necessary reaction frame
- Biaxial testing machine for elastomeric bearings
- Rock testing for universal compression point load test and Brazilian test
- Art-90 for psycho-physical, psychological and personality testing of drivers
- Instrumented van for monitoring air pollutants

Falling weight deflectometer for structural evaluation of overlays

SERVICES OFFERED

- CRRI offers a wide range of technical services to the user agencies through consultancy services. The institute's clientele includes central and state public works departments, Border Roads Organisation, Ministry of Surface Transport, Town and Country Planning Organisations, E-in-C Branch, Army Headquarters and Traffic Police. CRRI also undertakes user sponsored R&D works in thrust areas of highway engineering through sponsored and collaborative projects.
- CRRI also offers a wide range of specialized testing and calibration services to the user agencies.
- A range of information and documentation services is available to clients on request.

TRAINING COURSES

CRRI offers several training and development programmes at different levels tailored to suit the requirements of highway professionals, R&D organizations and educational institutions, in various areas of highway engineering. CRRI has also provided training to the road engineers of many foreign countries, like China, Nepal, Srilanka, Bhutan and Bangladesh.

Contact Person: Director, CRRI

PUBLICATIONS

The institute publishes *Road Abstracts* and its annual reports.

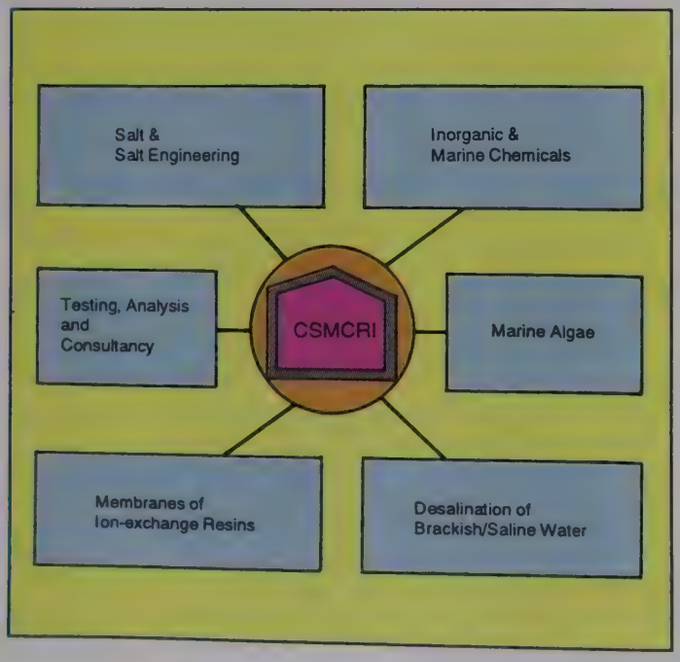
Central Salt & Marine Chemicals Research Institute (CSMCRI)

Gijubhai Badheka Marg, Bhavnagar 364 002
Telephone : 29496 Telegram: NAMAK, BHAVNAGAR
Telex : 0182-230 SALT IN FAX: 0278-26970
E. Mail: csmcri @ sirnetd.. ernet. in

Established: 1954
Director : Prof. P. Natarajan, Ph.D., F.A.Sc., F.N.A.
Budget for 1992-93: 374 lakh

MANDATE

- To carry out research and development work in the fields of salt, marine and other allied inorganic chemicals
- To develop technologies for the desalination of brackish and sea water
- To carry out survey and promote cultivation and utilization of marine algae
- To promote exploitation of coastal dune sand and saline soils through introduction and cultivation of indigenous and exotic plants of industrial value



MAJOR R & D PROGRAMMES

The major R&D programmes of CSMCRI relate to salt and salt engineering, marine chemicals, desalination of brackish/saline water, ion exchange resins and polymers, reverse osmosis, marine algae, inorganic chemicals, photoinorganic chemistry and phytosalinity.

SIGNIFICANT ACHIEVEMENTS

- The institute's R&D work has helped the salt industry in improving the yield and quality of their products. The all India average yield of salt per unit area has considerably improved as a result of R&D efforts of the institute.
- CSMCRI has developed reverse osmosis technology with membranes in spiral configuration for desalination of brackish water. Four stationary plants and three mobile desalination plants, based on this technology, have been installed in different parts of the country, under the Drinking Water Mission. One stationary and one mobile plants have been gifted to the Government of Thailand.
- Ten electrodialysis plants have been developed and installed for desalination of sea water based on a cost-effective technology evolved at the institute.
- CSMCRI has fabricated and operated pilot plants for the production of bromine, potassium chloride and refractory grade magnesia.
- R & D work of the institute has helped the industries based on algae and other plants as raw materials, in

Reverse osmosis water desalination plant

Bromine plant commissioned by CSMCRI, Bhavnagar at M/s Navin Fluorine Industries, Surat

improving the quality and yield of their products like agar-agar and alginic acid.

- The institute has developed an indigenous technology for the manufacture of thin film composite membranes.
- The institute has developed a technology based on low-cost batch submersion process for the production of iodized salt, which has been commercialized.
- Technologies have been developed for the production of potassium schoenite from marine mixed salt, sodium sulphate from sels mixture, potassium alum from mixed salt, alpha plaster of Paris, potassium nitrate, basic magnesium carbonate, magnesium trisilicate, epsom salt, magnesium hydroxide, synthetic calcium silicate, potassium nitrate and ammonium chloride.
- The institute has also developed solar stills.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Plants based on reverse osmosis technology developed by CSMCRI installed in different parts of the country and abroad (Governments of Gujarat, Rajasthan, Tamilnadu and Thailand)
- Technologies for free flowing table salt, dairy salt for butter and cheese, high purity AR grade sodium chloride and iodized salt (several parties)
- Bromine from sea bitterns (one party)
- Low density precipitated silica (two parties)
- Technology for demineralization of sugarcane juice (M/s Ponni Sugars & Chemicals Ltd)

Demineralization of sugarcane juice

TECHNOLOGIES READY FOR TRANSFER

- Jojoba body cream
- Deashing of sugarcane juice
- Free flow iodized salt
- Bacterial grade agar agar from sea weeds

MAJOR FUTURE PROGRAMMES

The future programmes of CSMCRI will be directed towards bringing about further improvement in design of salt washery for upgradation of salt quality, design and development of unit process operations for chemical treatment of brines, and purification by ion exchange and membrane cells. It is proposed to develop porous, bipolar liquid membranes and conducting spacers for better efficiency and cost-effectiveness in electrodialysis (ED) of saline water. Use of ED technology will be extended to the treatment of industrial effluents also.

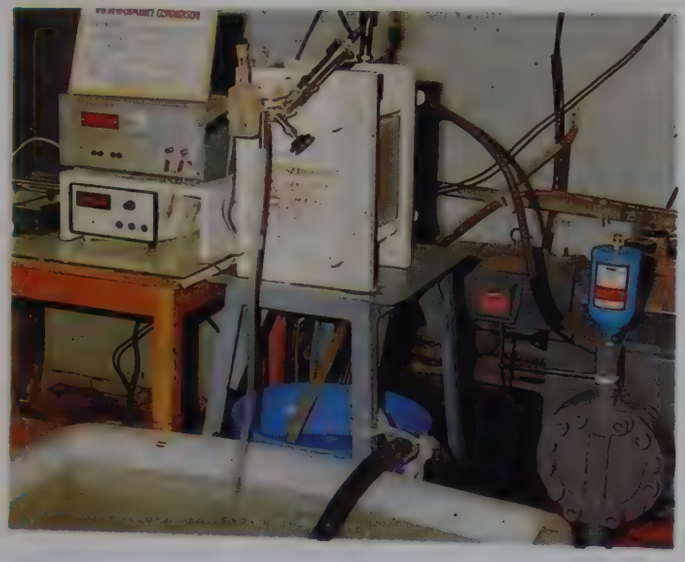
It is planned to survey marine wealth of India and quality and quantity of economic sea weeds. Cultivation techniques will be developed for iodine-rich weeds. Investigations on silica-based chemicals will be extended and catalytic systems and processes will be developed for conversion of syngas and other raw materials into value-added organic chemicals.

MAIN FACILITIES

- A wide range of modern instruments for characterization and structure determination of chemicals, e.g., equipment for X-ray diffraction, differential thermal analysis and gas chromatographic analysis; atomic absorption spectrometer, Fourier transform IR spectrometer, NMR spectrometer,etc.
- Instrumental facilities for surface area measurements, and determination of particle size and particle size distribution
- A well equipped workshop
- Library

SERVICES OFFERED

The institute has installed a number of plants for the desalination of water in different parts of the country, under the Drinking Water Mission. CSMCRI offers testing and analytical services on salt brine; water & soil samples; potassic fertilizers, soda ash; minerals like limestone, magnesite, dolomite, magnesia and gypsum; and samples of ion-exchange resins. Services are also available on china clay sieve analysis, particle size determination, and determination of traces of heavy metals in salt samples. The institute takes up consultancy work on problems related to its areas of specialization, specially those related to salt production and desalination of water.



Reverse osmosis water desalination system with thin film composite membranes

Mobile desalination unit being handed over to Thailand's minister of Science & Technology and Energy

TRAINING COURSES

The institute organizes short-term training courses in the areas of its specialization.

PUBLICATIONS

CSMCRI brings out a news bulletin, *CSMCRI Newsletter,* and its annual reports.

Contact Person: Director, CSMCRI

FIELD STATIONS

CSMCRI Marine Algal Research Station
M.S. Bungalow, P.O. Mandapam,
Ramnad District,
Tamilnadu 623 518

CSMCRI Sea Water Irriculture Field Station
House No. 20/3, Satya Niwas
Hill Patna, Berhampur, Ganjam District
Orissa 760 005

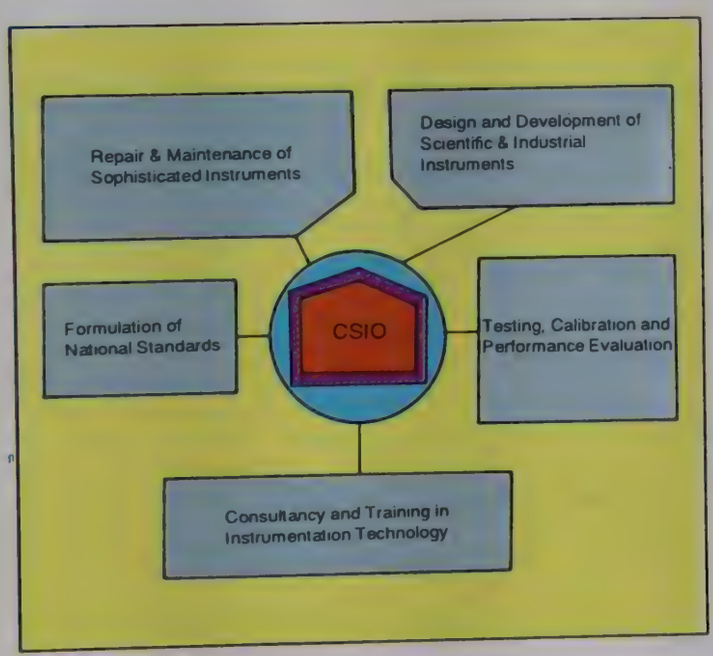
Central Scientific Instruments Organisation (CSIO)

Sector 30, Chandigarh 160 020
Telephone: 400 90 Telegram: CENINSTS CHANDIGARH
Telex: 0395-300 CSIO IN FAX : 0172-40527

Established: 1959
Director: Dr K.R. Sarma, M.Tech. (IIT, Kharagpur), Ph.D. (Cornell)
Budget for 1992-93 : Rs 598 lakh (RE)

MANDATE

- To undertake research on design and development of scientific and industrial instruments, their components and instrument systems
- To undertake repair and maintenance of sophisticated instruments through a network of regional centres
- To offer technical assistance to industries and various other users of instruments by way of fabrication, testing, calibration, analysis and performance evaluation, etc.
- To provide training in instrument technology aimed at human resource development for the benefit of precision instrument industry and R&D institutions
- To survey and assess the present and future needs of various types of scientific and industrial instruments in the country and to collate, co-ordinate and disseminate information on the subject
- To evolve national standards for instruments in collaboration with other institutes
- To assist in the formulation and co-ordination of policies and procedures related to the development of instrument industry


Repair & Maintenance of Sophisticated Instruments
Design and Development of Scientific & Industrial Instruments
Formulation of National Standards
CSIO
Testing, Calibration and Performance Evaluation
Consultancy and Training in Instrumentation Technology

MAJOR R&D PROGRAMMES

The major R & D programmes of CSIO relate to development of instruments for microelectronics, special defence needs, medical applications, geo-scientific studies, environment monitoring, robotics and process control, coherent and integrated optics. Development of analytical instrumentation for use in agriculture, food processing, narcotics and explosives is also a major R & D programme of CSIO.

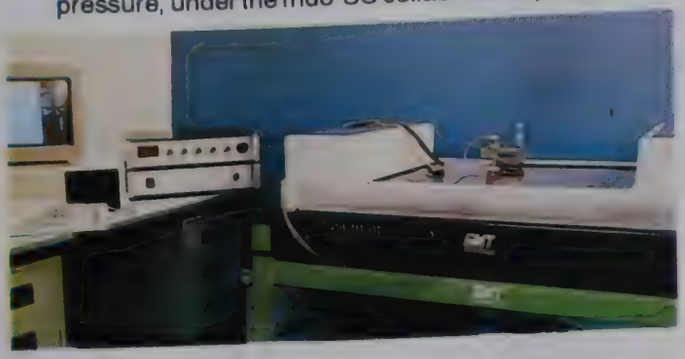
SIGNIFICANT ACHIEVEMENTS

- Development of a 4 MeV linear accelerator for radiation therapy of cancer patients, in collaboration with SAMEER group of Bombay and PGI, Chandigarh

4 MeV 'Jeevan Jyoti' Linac — a linear accelerator for radiation therapy of cancer patients

- A package consisting of low-cost dedicated entry system, blood analysis system and equipment for dental care has been developed for primary health centres
- Development of an equipment for testing psychophysical responses of vehicle drivers

- Development of a Scanning Tunneling Microscope (STM), suitable for operation in air at atmospheric pressure, under the Indo-US collaborative programme



Scanning Tunneling Microscope developed by CSIO, Chandigarh

- Development of a Scanning Electron Microscope (SEM) having a resolution of 75Å, under a DST-sponsored, multi-agency collaborative programme

Scanning Electron Microscope

- Development of PC-based, double beam, UV-visible spectrophotometer and microprocessor based atomic absorption spectrophotometer

PC-based, double beam, UV-Visible Spectrophotometer

- Development of agri-electronic instruments of direct benefit to farming community and agricultural scientists: a field usable soil *p*H meter, a portable digital soil salinity tester and a specific ion analyzer for soils
- Development of a 10-point fibre optics communication system for use in mines
- Development of an optical methanometer for measuring methane gas content in coal mines environment
- Development of profile projector objectives of 10X, 20X, 25X, 50X, and 100X magnification
- Development of C-MOS technology based digital cassette seismograph
- Development of an automobile exhaust smoke density monitor

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Field usable soil *p*H meter [M/s Naina Electronics (P) Ltd, Chandigarh]
- Portable digital soil salinity tester (M/s ELICO, Hyderabad)
- Microprocessor-based atomic absorption spectrophotometer (M/s ELICO, Hyderabad)
- PC-based double beam, UV-visible spectrophotometer (M/s Systronix, Ahmedabad)
- 4 MeV linear accelarator for radiation therapy (consortium of BHEL, ECIL, BEL, IL and Andrew Yule)
- Cu-Zn-Al shape memory alloy (M/s Suraksha Firetech, Allahabad)
- Profile projector objectives, 10X, 20X, 25X, 50X and 100 X magnification (M/s Accurate Optics, Chandigarh)
- Automobile exhaust smoke density monitor (M/s Envirotech, New Delhi)

TECHNOLOGIES READY FOR TRANSFER

- Scanning tunnelling microscope (for operation in air)
- Laser scanning micrometer
- LSI/VLSI tester
- Scanning electron microscope (75 Å resolution)
- Electron beam controlled evaporation system (UHV compatible)
- Automatic wafer prober
- Ultrasonic range sensor for robotics
- Specific ion analyzer for soils
- On-line chloride monitoring system for soda ash industry

LSI/VLSI testing system

MAJOR FUTURE PROGRAMMES

The major future programmes of CSIO relate to the development of the following systems:

- *Instrumentation for micro-electronics:* Molecular beam epitaxy system, reactive ion beam etching system, reactive ion etching system, stepper optical lithogrpahy, ion implantation system, RF/DC sputtering system, electron beam controlled evaporation system, LSI/VLSI testing system
- *Medical instrumentation:* 15 MeV linear accelerator, patient support system for medical use, endoscopes, ophthalmoscope/otoscope diagnostic set, low-cost ultrasound scanner, hyperthermia system for localized cancers, pulse oximeter, computerized stress exercise system, tonometer, interpretative electrocardiograph, etc.
- *Instrumentation for special defence needs:* Head-up display system for light combat aircraft (Drishti), 35mm mini-panoramic camera
- *Geo-scientific instruments:* Land-based digital data telemetry system,inclinometers/tiltmeters for on-site analysis of civil structures and earth tilts, solid state memory-based intelligent seismic data recorder, strainmeter, etc.
- *Analytical instruments:* Analytical instruments for sectorial needs (food processing, explosives and narcotic detection), e.g., digital refractometer, NIR/FTNIR analyzer for moisture in grains, fats and NSF in milk, oil seeds, etc., vapour detection/ion mobility spectrometer, glow discharge lamp; atomic emission spectrometer; Hi-tech instruments, e.g., atomic force microscope; agri-electronic instruments, e.g., electromagnetic soil salinity tester and integrated instrumentation for plant physiology and agro-meteorological parameters
- *Integrated optics & coherent optics:* Development of optical integrated circuit (OIC) devices; development of fibre optic holography and fibre optics technology for communication applications

MAIN FACILITIES

- Modulation transfer function (MTF) test bench
- Computer facilities
- Precision optical processing facility
- CNC milling machine facility

SERVICES OFFERED

CSIO offers services for analytical testing, calibration, metallography and heat treatment, etc., to industry and other user agencies. Services are also offered to solve specific problems of the industry.

Service and maintenance of scientific instruments is carried out by the division at Chandigarh as well as through a network of regional centres located at New Delhi, Madras and Jaipur. Servicing on contract basis is also taken up.

TRAINING COURSES

The Indo-Swiss Training Centre (ISTC) at CSIO conducts the following Diploma Courses with a view to imparting technician- level training in precision instrument technology: Three-year diploma course in instrument technology, one-year post-diploma course in industrial electronics and four-year advanced diploma course in die & mould making.

PUBLICATIONS

CSIO publishes *CSIO Communications* (quarterly); *Directory of Scientific Instruments & Components Manufactured in India*, and *CSIO News* (Bimonthly)

Contact Person: M. G. Joshi, Scientist, CSIO

REGIONAL SERVICE & MAINTENANCE CENTRES

Service & Maintenance Centre
CSIR Complex, 2nd Floor, NPL Campus,
Hillside Road, New Delhi 110 012

Service & Maintenance Centre
CSIR Complex, Taramani,
Madras 600 113

Service & Maintenance Centre
Plot No. CFC-I,
Malaviya Industrial Area,
Jaipur 302 017

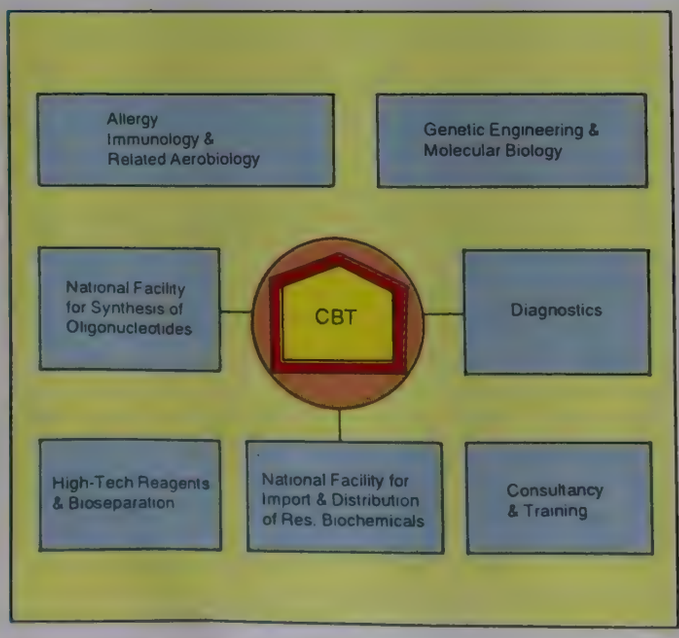
Centre for Biochemical Technology (CBT)

Delhi 110 007
Telephone : 7257471 Telegram : BIOCENTRE DELHI
Telex : 031- 78085 CFB-IN FAX: 7257471
E. Mail : cfb@sirnetd.ernet.in

Established : 1966
Director : Dr S. V. Gangal, Ph.D.
Budget for 1992-93 : Rs 207 lakh

MANDATE

- To promote production of commercially viable technologies by (i) testing and upscaling processes standardized on a bench scale in different national laboratories/universities, (ii) developing infrastructure and expertise for studying customer acceptance & costing and (iii) preparing project reports for the benefit of potential entrepreneurs
- To produce and supply important biochemicals needed in biological research as a service, until these are taken up for routine production by a commercial undertaking
- To help in the off-the-shelf supply of research chemicals and biochemicals, especially those required for advanced biological research, through establishment of a commercial undertaking and to feed such a commercial undertaking continuously by developing methodologies for preparing newer products
- To upgrade the existing technologies by exploiting new developments in the field of biotechnology
- To conduct research on indigenously available natural products (venoms, gums, seeds, etc.) with a view to isolating chemicals needed for research and to exploit their commercial potential


Allergy Immunology & Related Aerobiology
Genetic Engineering & Molecular Biology
National Facility for Synthesis of Oligonucleotides
CBT
Diagnostics
High-Tech Reagents & Bioseparation
National Facility for Import & Distribution of Res. Biochemicals
Consultancy & Training

MAJOR R & D PROGRAMMES

The major R & D programmes of CBT relate to allergy and immunology, diagnostics, genetic engineering, bio-organics and high tech reagents.

SIGNIFICANT ACHIEVEMENTS

- CBT has been a pioneer in the country for manufacture and supply of allergenic extracts for diagnosis and therapy of respiratory allergic disorders. Standardization of allergenic extracts, studies of atmospheric biopollutants like pollen and fungi, and studies on agents causing extrinsic hypersensitivity, pneumonitis, etc. are being actively pursued.
- CBT has developed chemical and immuno-chemical kits for use in clinical diagnosis and an immuno-chemical kit for the early diagnosis of aspergillosis.
- Expertise has also been developed in gene synthesis and expression and the present thrust is on developing hyper producers for restriction enzymes and other important enzymes, development of efficient gene expression and recombinant DNA products like epidermal growth factor.
- The Centre has established a national facility for synthesis of oligonucleotides. It is supplying oligonucleotides of defined sequences to the workers in molecular biology.
- Expertise for the preparation of Fmoc and Boc protected amino acids required for peptide synthesis has been developed and the Centre can now supply custom-made peptides.
- Methodology has been developed for large-scale isolation of phospholipids and glycosphingolipids and other biochemicals, and methods have been standardized for production of new biochemicals such as lectins, enzymes, substrates and other biologically important reagents.
- CBT is recognized as a test laboratory by the Department of Environment and Forests for testing samples

related to environmental pollution. It has also developed a testing facility for PCP content in leather which needs to be checked for leather exports.

MAJOR TECHNOLOGIES TRANSFERRED

- Fourteen clinical diagnostic kits, conforming to international standards, for estimation of different parameters of body fluids have been developed and transferred to industry.
- Methodology for preparing hyaluronic acid of high molecular weight from rooster coombs, used in ophthalmic surgery, has been developed and released to M/s Cadilla Laboratories, Ahmedabad.
- Technology for preparing Fmoc derivatives of more than a dozen amino acids has been standardized. Negotiations are underway for transfer of technology through the Department of Biotechnology.

TECHNOLOGIES READY FOR TRANSFER

- A process has been developed for the preparation of bovine serum albumin (95% purity), a much needed product in biomedical research.
- The following clinical diagnostic kits have been developed: LDH, LDH isoenzymes, cholinesterase, gamma glutamyl transpeptidase, glucose-6-phosphate dehydrogenase, isocitrate dehydrogenase, angiotensin converting enzyme, glycohemoglobin, reference sera, control sera, phosphorus, barbiturates, HDL, LDL, and VLDL cholesterol, creatine phosphokinase
- Processes for preparation of high grade cytochrome C and *p*- nitrophenyl phosphate

MAJOR FUTURE PROGRAMMES

Emphasis will be laid on development of technologies for more products needed in biomedical research specially through recombinant DNA technology and bioseparation. New areas under lipids and complex carbohydrates, protein engineering will be taken up for studies. Some specific areas of attention will be: antigenic/allergenic determinants in common airborne grass pollen grains; immune response to liposome entrapped allergens with special reference to its potential in immunotherapy; genetic fusion and expression of S1 subunit of pertusis toxin and A- subunit of cholera toxin to B-subunit of anthrax toxin: comparison of B-subunits to deliver antigens; purification of enzymes for enzyme-based diagnostic kits; molecular characterization of atopic allergy; development of NADH-based fluorescence sensors for bioprocesses monitoring; lectins (of plant and animal origin) as biochemical tools. In addition, the Centre wishes to establish a facility for tissue culture, and a hybridoma facility for preparing antibodies.

MAIN FACILITIES

- The National facility for the synthesis of oligonucleotides is already catering to the needs of Indian scientists for the synthesis of oligonucleotides of defined sequences.

Gene assembler

- With the support of DBT, the National facility for preparation of restriction enzymes and other fine chemicals at CBT will, in near future, provide a wide range of restriction enzymes, required for genetic engineering.
- Expertise for synthesis of biologically active peptides exists at the Centre; the facility for custom-made synthesis of small peptides for research is also available.
- The Centre houses the National Facility for import and distribution of enzymes and fine chemicals

SERVICES OFFERED

- Supply of important biochemicals needed in research
- Ministry of Environment and Forest - recognized testing centre for pollution checking
- A leather testing unit

TRAINING COURSES

CBT conducts workshops on allergy and immunotherapy every year in the months of April and October.

PUBLICATIONS

The Centre publishes its annual reports.

Contact Person : Director, CBT

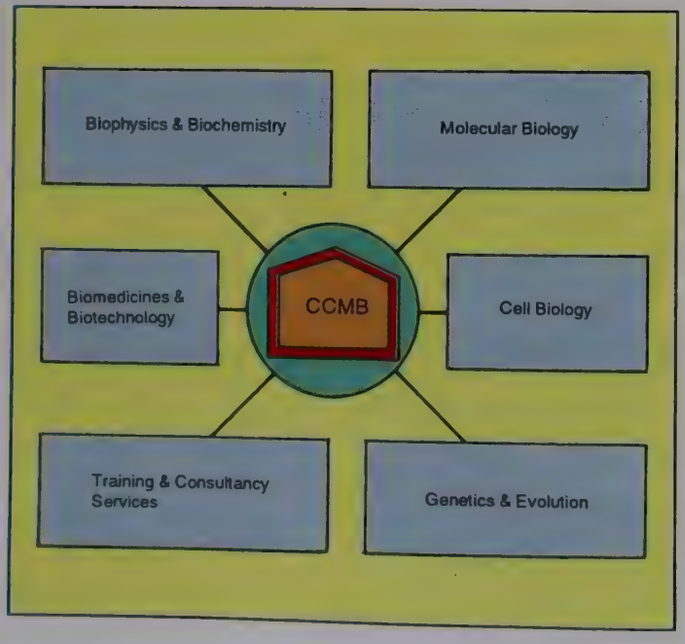
Centre for Cellular & Molecular Biology (CCMB)

Uppal Road, Hyderabad 500 007
Telephone : 852241-50 Telegram: BIOCENTRE HYDERABAD
Telex: 0425-7046 CCMB IN, 0425-7061 IICT IN FAX: 0842-851195

Established: 1977
Director: Prof. D. Balasubramanian, M.Sc., Ph.D. (Columbia, USA)
Budget for 1992-93 : Rs 623 lakh

MANDATE

- To conduct research in frontier and multi-disciplinary areas of modern biology and to seek potential applications of this work
- To carry out exploratory work for the development of modern biochemical and biological technologies in the country
- To train people in advanced areas of biology, specially in the techniques for which adequate facilities may not exist elsewhere
- To provide centralized facilities in the country for new and modern techniques in inter-disciplinary areas of biology
- To collect, collate and disseminate information relevant to biological research

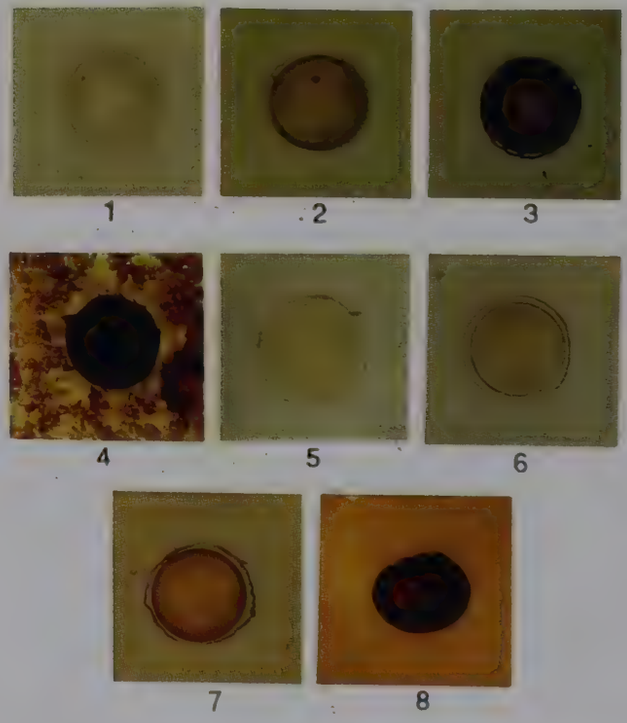


MAJOR R&D PROGRAMMES

The major R & D programmes of CCMB relate to the disciplines of biophysics & biochemistry; molecular biology; cell biology; genetics & evolution; biomedicines & biotechnology.

SIGNIFICANT ACHIEVEMENTS

- Studies have been carried out on the ability of certain microorganisms to adapt to various adverse circumstances, such as high salt concentrations in the environment. Work done at CCMB has identified the proU locus in *Escherichia coli* as encoding an osmotically inducible active transport system for uptake of glycine betaine and L-proline, which play an essential role in adaptation to osmotic stress. This locus comprises three genes organized as an operon, whose products constitute a protein transporter across the cell membrane.
- CCMB work has demonstrated the occurrence of light-induced changes and photosensitized damage to the eye lens from endogenous substances. The reason for



Cataract formation study showing colouration and opacification of rat lenses incubated with various dilutions of FSC/CSC. (1) control lens, incubated with buffer alone; and with buffer containing FSC; (2) at 1:10 dilution; (3) at 1:5 dilution; and (4) FSC, no dilution; (5) with buffer containing CSC; (5) at 1:10 dilution; (6) at 1:5 dilution; (7) at 1:2.5 dilution; and (8) CSC, no dilution

the increased risk of cataract among smokers has been explained. Smoke has been found to contain reactive oxygen species which oxidize the lens constituents and damage the lens leading to cataract. Another important observation is that the eye lens proteins, the crystallins, are able to bind to calcium ions.

- The Centre has developed a DNA probe for 'DNA fingerprinting' for identification of individuals. This method utilizes a DNA probe derived from a sex chromosome-specific region of an Indian snake, the banded krait. This probe has now been successfully used in a number of forensic cases and paternity disputes, and the evidence so provided has gained acceptance in Indian courts of law.

- Analysis of the soil and water samples collected during the Fourth Indian Scientific Expedition to Antarctica, has led to the identification of ten unique isolates of bacteria. Several other bacterial and yeast species resemble species found elsewhere, except that the Antarctica species are cold-adapted.

- Considerable insight has been obtained in the area of malignant transformation. On the basis of animal models, specific tumour-associated transplantation antigens have been identified, and the altered expression of certain oncogenes in tumour cells has been demonstrated. A new tumour, the AK-5 histiocytoma, has been established in the Wistar strain of rats. A unique feature of this tumour is its high rate of spontaneous rejection, which thus offers AK-5 as a model system for studying the general mechanism of tumour rejection.

- The involvement of the oncogene-product p^{21}*ras* in the signal-transduction pathway in normal cells has been established. A tyrosine-specific protein kinase and a phosphotyrosine phosphatase, which may function in normal signal transduction, have been characterized in detail, and the gene coding for the phosphotyrosine phosphatase has been cloned and sequenced.

- Studies on the mechanism of transcription have led to a mapping of the functional domains in *E.coli* RNA polymerase and an understanding of the effect of promoter strength upon transcription. Based on theoretical studies, new sites of interaction have been identified in the 16S-23S ribosomal RNA complex.

- CCMB work on synthetic peptides has provided important insight into the conformational preference for signal sequences of secreted proteins. Protein receptors which recognize nuclear localization signal sequences and thereby regulate the entry of proteins into the nucleus have been identified by using photolabelled synthetic peptides.

- Studies on seminalplasmin and shorter synthetic peptides derived from it have delineated regions of the protein responsible for its antibacterial and membrane-perturbing properties. Other studies in the area of reproductive biology include a detailed analysis of the mechanism of action of estradiol and its effects on target tissues.

Peptide synthesis facility

MAJOR FUTURE PROGRAMMES

Studies will be carried out to understand molecular aspects of cataractogenesis in the eye lens, structure & conformation of nucleic acids & proteins, molecular mechanism of secretion and transport of proteins, molecular basis of membrane structure and function, gene regulation in microorganisms & genetics of osmoregulation.

MAIN FACILITIES

- Protein analysis and peptide and DNA synthesis facilities
- Cell culture facility
- Laboratory animal facility
- Modern analytical facilities including NMR spectroscope, electron microscope and a nanosecond fluorimeter
- BIOINFORMATICS -- Distributed Information Centre having on-line access to international databases

TRAINING COURSES

CCMB provides specialized training to scientists from other institutions in the country and abroad, in advanced areas of biology.

PUBLICATIONS

The laboratory publishes its annual reports and a newsletter, *CCMB Highlights*

Contact Person: Director, CCMB

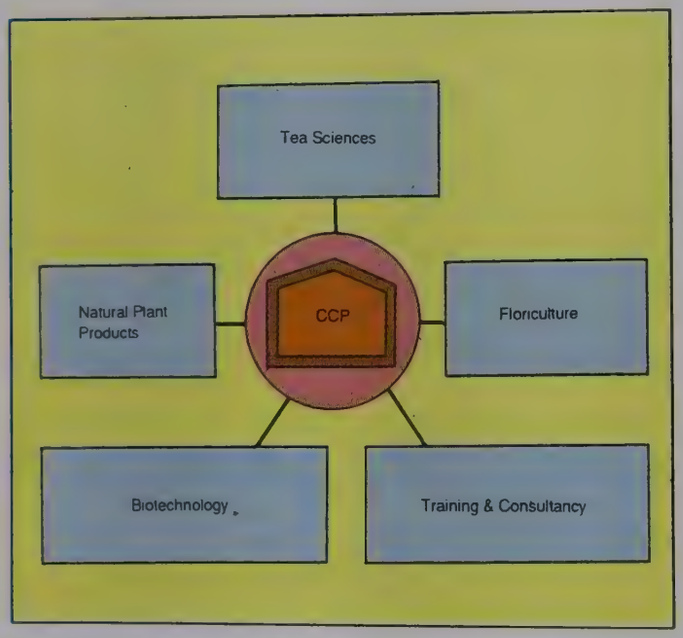
CSIR Complex Palampur (CCP)

Palampur, H.P. 176 061
Telephone 01894 - 2340, 2945 Telegram: CONSEARCH PALAMPUR (H.P.)
FAX : c/o D.T.O. 01892-4113 (Dharamsala)

Established: 1983
Director: Prof. Akshey K. Gupta, M.Sc. (Ag.Bot.), Ph.D., FNAS
Budget for 1992-93: Rs 184 lakh

MANDATE

- To conduct basic and applied research on economic plants
- To conduct research relevant to plantation, forest, agriculture and horticulture produce with a view to value addition and providing technological support for the development of the existing and new industries in the hilly region
- To assist the growers and industrialists through consultancy, contract research, training, etc.



MAJOR R&D PROGRAMMES

The major R&D programmes of the laboratory relate to floriculture, tea sciences, biotechnology and natural plant products.

SIGNIFICANT ACHIEVEMENTS

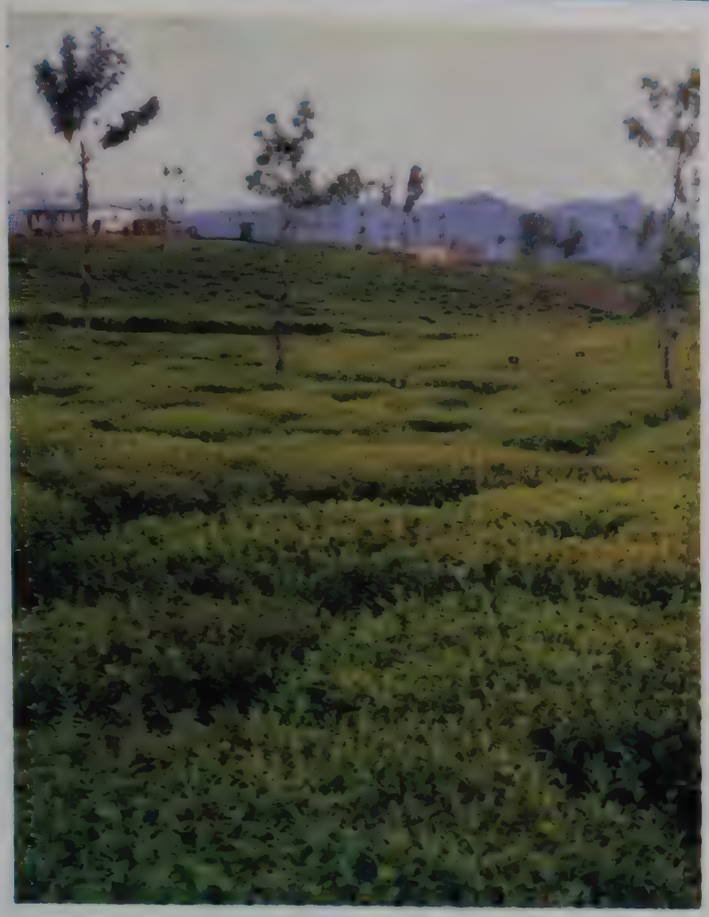
- Development of agrotechnologies for cultivation of tea, mushrooms, gladiolus, chrysanthemum, rose, carnation, tuberose, etc.
- Standardization of techniques for tea processing, and essential oil distillation

Plantlets growing from single node explants of elite line of bamboo (*Dendrocalamus hamiltonii*)

- Increase in the shelf-life of *Kinnow* and *Litchi* fruits
- Development of tissue culture techniques for mass propagation of elite planting materials of tea and maggar bamboo, and for supply of disease-free plants
- Development of low-cost compost making unit and green houses (polyhouses)

MAJOR TECHNOLOGIES TRANSFERRED

- Agrotechnology for rejuvenation of old China hybrid tea in Himachal Pradesh
- Technologies for cultivation of Bulgarian rose *(Rosa damascena)* and wild marigold *(Tagetes minuta)*
- Distillation units for rose oil and tagetes oil
- Spawn making for mushrooms
- Commercial cultivation of flowers in Himachal Pradesh



Tea demostration farm Banuri, Palampur

TECHNOLOGIES READY FOR TRANSFER

Agrotechnology packages are available on tea and tea processing; tea-based soft drink concentrates; cultivation of rose and *Tagetes minuta*; rose oil and tagetes oil distillation; year-round production of cut-flowers like gladiolus, chrysanthemum, carnation and tuberose; low-cost compost making for button mushroom, low-cost greenhouse (polyhouses); and *in vitro* propagation of tea and maggar bamboo.

MAJOR FUTURE PROGRAMMES

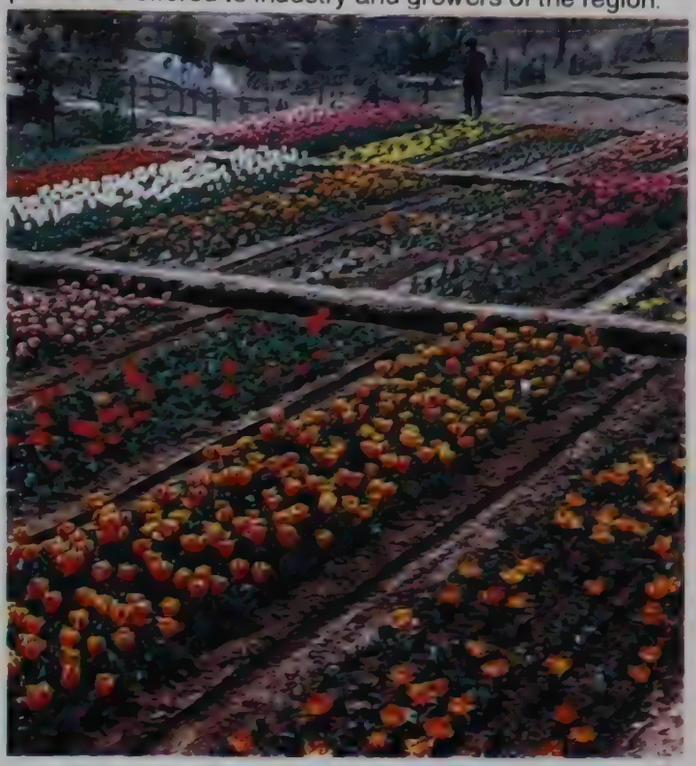
The major future programmes of CCP relate to agrotechnology packages on tea, green and black tea processing and other value- added products from black tea; cultivation and processing of new crops. Programmes will be taken up on improvement in production and quality of aromatic crops like lavender, *Cestrum nocturnum* and tuberose; agrotechnologies for production of disease-free export quality plants and flowers; production of synthetic seeds exploiting somaclonal variation. Biodiversity conservation and sustainable management of herbal plants will also be taken up.

MAIN FACILITIES

- A wide range of sophisticated instruments for quality evaluation
- Radio isotope facilities
- A well-equipped tissue culture lab
- Distillation facilities for high-valued aromatic plants on pilot plant scale
- Computer facilities

SERVICES OFFERED

Consultancy services for the development of economic plants are offered to industry and growers of the region.



Select varieties of tulips at Palampur

TRAINING PROGRAMMES

Training programmes are regularly organized on agrotechnologies and processing technologies for tea, essential oil bearing plants, cultivation of flowers for ornamental purposes, efficient management/regeneration of rare plants and tissue culture methodologies.

PUBLICATIONS

The laboratory publishes a newsletter and its annual reports. Technology bulletins and brochures are issued periodically.

Contact Person: Director, CSIR Complex Palampur.

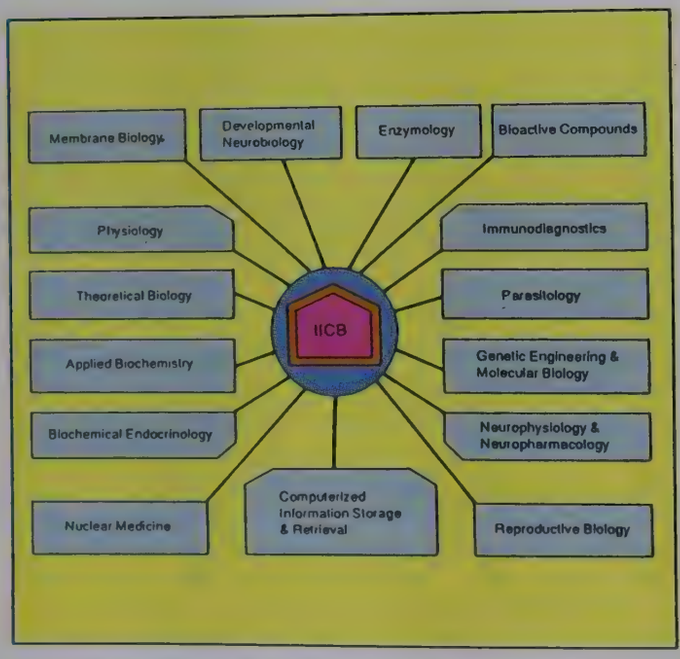
Indian Institute of Chemical Biology (IICB)

4 Raja S.C. Mullick Road, Calcutta 700 032
Telephone: 733491, 730492, 734503 Telegram: LIVINGCELL, CALCUTTA
Telex: 021-7108 IICB-IN FAX: 91-33-730284

Established: 1935 (Taken over: 1956)
Director: Dr A.N. Bhaduri, M.Sc. (Tech.), D.Sc.(Mich), F.A.Sc., F.N.A.
Budget for 1992-93: Rs 520 lakh

MANDATE

- To conduct research in biological sciences for seeking solution to medical and biological problems faced by the country and utilize the results for biotechnological and biomedical applications
- To utilize its R&D expertise and resources for research in frontier areas of modern biology
- To strive to achieve an appropriate balance between long-term research of basic nature and short-term research of commercial potential.



MAJOR R & D PROGRAMMES

The major R&D programmes of the institute comprise: research on natural products of medicinal, biological and industrial value and synthetic duplication of products of interest; development of innovative immunoassay techniques; understanding the basis of parasitism and development of biotechnologies applicable to the diagnosis and chemotherapy of visceral leishmaniasis; investigation of the molecular basis of pathogenicity of *Vibrio cholerae* and development of an effective, long-acting oral vaccine against cholera infection; development of novel approaches towards fertility control and regulation; delineation of the cellular & molecular basis of brain development, and genesis and prevention of movement disorders; investigation of gastric physiology; development of tissue-targeted drug-delivery systems; investigation of the molecular mechanism of biocatalysis; studies on the biosynthesis and liberation of carbohydrases in higher fungi; development of radiopharmaceuticals for myocardial imaging and renal and hepatobiliary studies; development of protein engineering facilities and of theoretical treatment and models for self- organizational phenomena in living systems.

Laboratory work in progress in biophysics

SIGNIFICANT ACHIEVEMENTS

- IICB has developed a bacteriophage typing technique for identifying cholera infection, which has become widely accepted and won the recognition of WHO.
- A process developed by the institute for preparation of gelatin optical filter has been commercialized.
- Methods have been evolved for preparation of high-value lectins from cheap agricultural and marine resources.

- A wild weed *Kallstroemia pubescens* has been identified to be a viable alternative source of diosgenin, a steroid drug intermediate.
- A process for chemical conversion of quinine sulphate to quinidine sulphate, an antiarrhythmic drug, has been licensed to industry.
- Immunoassay kits have been developed for estimating testosterone, cortisol, triiodothyronine, and thyroxine.

MAJOR FUTURE PROGRAMMES

The major future R & D programmes of IICB will include development of DNA probes for the diagnosis of leishmanial infections and development of long-acting, oral vaccine for cholera.

Polyacrylamide gel electrophoresis of RNA

MAIN FACILITIES

A wide range of facilities are available in the institute which include:

- DNA synthesizer
- Refrigerated centrifuges, ultracentrifuges and freeze driers
- Fraction collectors, microfermenter and amino acid analyzers
- Liquid scintillation counters
- Spectrophotometers, spectrofluorimeters, NMR, GC-mass spectrometer, transmission electron microscope, ORD-CD and HPLC equipment
- Computer facilities
- Library
- Modern animal house

Ultracentrifugation facility

Laboratory visit of students

SERVICES OFFERED

IICB provides analytical and testing services to industry and other institutions.

TRAINING COURSES

The institute actively participates in and sponsors conferences/symposia/workshops in its areas of interest, and organizes in-service and *ad hoc* training programmes from time to time.

PUBLICATIONS

The institute publishes its annual reports.

Contact Person: Director, IICB

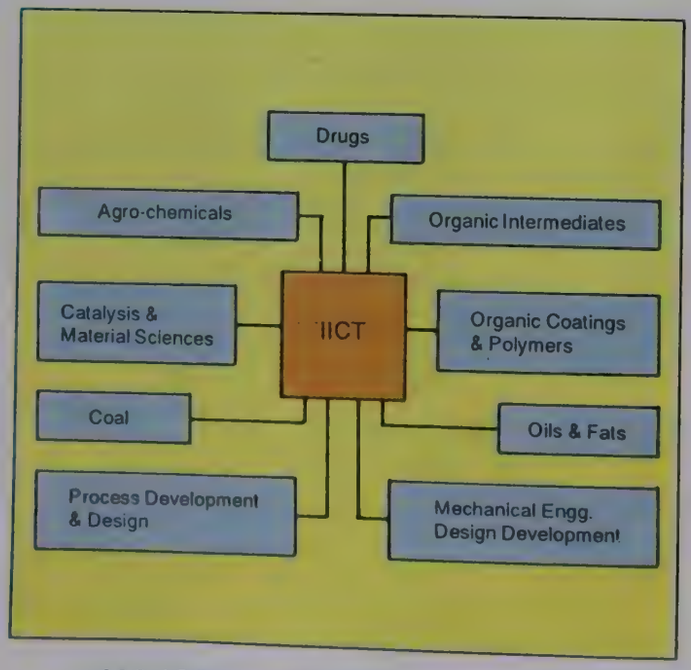
Indian Institute of Chemical Technology (IICT)

Uppal Road, Hyderabad 500 007
Telephone: 853874 Telegram: RESEARCH HYDERABAD
Telex: 0425-7061; IICT IN FAX: 0842-853757 & 0842-854757

Established: 1944; Taken over by CSIR in 1956
Director : Dr A.V. Rama Rao, Ph.D (Tech), D.Sc, F.I.A.Sc, F.N.A.
Budget for 1992-93:Rs 1077 lakh

MANDATE

- To carry out research and development work in the field of chemical technology; to develop processes/products/designs and engineering knowhow based on utilization of indigenous raw materials/resources/skills
- To provide S&T inputs to the industrial and economic development of the country by: (i) improving the efficiency of existing plants; (ii) providing technical consultancy services; and (iii) providing analysis and testing services
- To advise the government, as and when required, in areas where the institute has developed technical capability/expertise
- To carry out basic research in areas of chemistry and chemical technology



MAJOR R & D PROGRAMMES

The major R&D programmes of IICT relate to the development of technologies for pesticides, drugs, organic intermediates and fine chemicals, catalysts, polymers and organic coatings, utilization of low-grade coals, and value-added products from vegetable oils. Process design and mechanical engineering design form an integral part of technology development and transfer.

IICT is also actively engaged in basic research in organic synthesis and catalysis.

Organic synthesis, a major activity at IICT

SIGNIFICANT ACHIEVEMENTS

- IICT has developed technologies for several pesticides, widely used in the country, like Monocrotophos, Butachlor, DDVP and MBC, Chlorpyriphos, Diazinon and Quinalphos.Technologies for all these pesticides are in commercial production by several parties and about 60% of the technical pesticides produced in the country are estimated to be based on IICT technologies.
- Innovative and cost-effective technologies have been developed by IICT for the production of life saving drugs like Etoposide (anti-cancer), AZT (anti-AIDS),

Monocrotophos plant of NOCIL, based on IICT technology

Metoprolol and Nadolol (cardiovascular), Timolol maleate (anti-glaucoma), Norfloxacin, Ciprofloxacin(antibacterials), Ketorolac (analgesic), Gemfibrozil and many others. In many cases technologies have been developed for the first time in the country.

- IICT has developed a catalyst for hydrogenation of benzene to cyclohexane. The catalyst is being commercially produced and is in use.

- Extensive studies carried out at IICT on pilot plant scale for low temperature carbonization (LTC) of low grade coals to produce smokeless fuel have led to the establishment of a 900 tonnes per day LTC plant for the first time in the country.

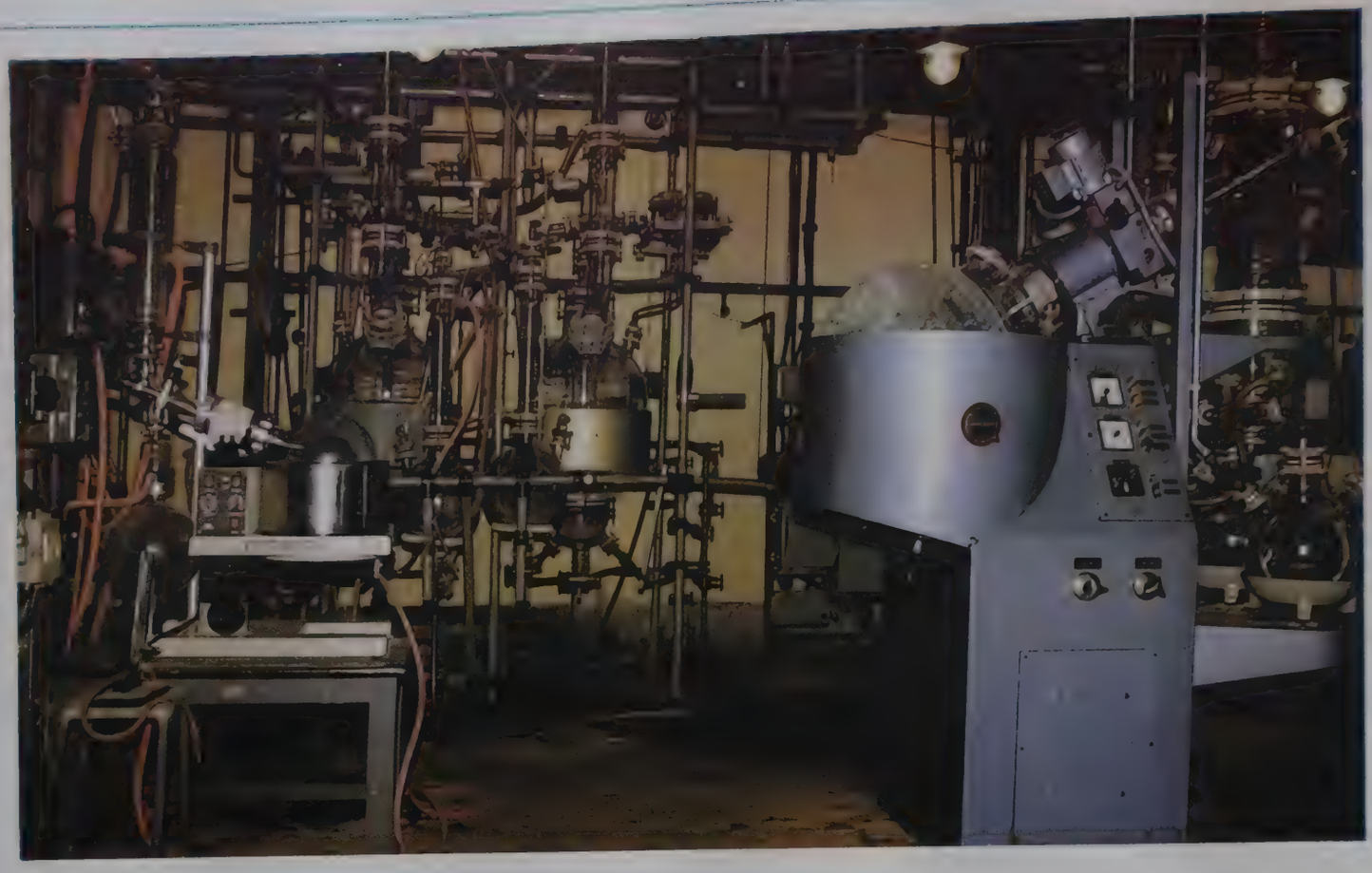
- IICT has carried out studies on gasification of coal on a pilot plant of 1 tonne per hour which will be useful for designing integrated gasification combined-cycle plant for power generation in the country.

- Exhaustive studies carried out by IICT on processing of cottonseed have helped in the large scale growth of the cottonseed processing industry in the country. Processes have also been developed to produce value-added products from castor oil.

- Glyoxal, an intermediate for drugs and resin manufacture, was produced for the first time in the country based on a technology developed by IICT.

- IICT has developed technology for the production of sodium azide, a mild detonator used both for civil and defence purposes. The product meets stringent international specifications. A 100% export oriented unit based on IICT technology is in operation.

- IICT has developed technology for cyanuric chloride for the first time in the country. The technology for production of cyanuric chloride was, earlier, a closely guarded secret held by only two multinational companies in the world.



Pilot plant equipment at IICT for development of technologies

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

Over 70 technologies have been transferred by IICT to the industry, 50 of them are already in commercial production.

- Monocrotophos (released to ten parties; already in production by NOCIL, Sudershan Chemical Industries, Vantech and NICL)
- Glyoxal (Manish Organics India Ltd, and Rajasthan Glyoxal Ltd)
- Norfloxacin and Ciprofloxacin (CIPLA)
- AZT (CIPLA)
- Hydrazine hydrate (Andhra Farm Chemicals Corporation)
- Benzyl chloride and related chemicals (DCM); Catalyst for hydrogenation of benzene to cyclohexane (GSFC)
- Etoposide (CIPLA)
- Metoprolol and Nadolol (Lupin)
- Low temperature carbonization of coal (Coal Chemicals Complex, Singareni Colleries Company Ltd)
- S-Timolol maleate (FDC Ltd)
- Gemfibrozil (Cadila)
- Technologies for adhesives (more than 12 parties).

MAJOR FUTURE PROGRAMMES

- Development of technologies for environmentally safe pesticides
- Development of cost-effective and innovative technologies for life saving drugs
- CO-based chemicals
- CFC substitutes and other fluorocarbons
- Catalysts (both homogeneous and heterogeneous) for industrially important chemical processes
- Process design and development for bulk organic intermediates
- Design and engineering of commercial plants
- Hazard and risk analysis of chemical plants

MAIN FACILITIES

- IICT offers technologies, particularly for bulk products, along with basic/detailed design for commercial plants with guarantees on raw material consumption, quality of the product and capacity of the plant.
- IICT works in close collaboration with industry. Most of the projects are sponsored. In fact, the entire programme in the area of drug technologies is sponsored by the Indian drug industry

CIPLA's etoposide plant based on IICT technology

- In majority of the cases, technologies are developed on pilot plant scale. For this purpose laboratory is well equipped with pilot plants for various unit operations. In addition, dedicated pilot plants are set up for specific projects.

Cyanuric chloride pilot plant at IICT

- Modern instruments for characterization and structural determination of chemicals are available.
- Computer-aided design centre for design, simulation and optimization studies.
- A well stocked library in the area of chemical and biological sciences.

SERVICES OFFERED

- Development of technologies on contract basis
- Basic/detailed design of commercial plants and commissioning assistance
- Analysis and testing facilities for industry
- Simulation, optimization and control of process plants
- Hazard and risk analysis of chemical and petrochemical plants
- Toxicity evaluation of pesticides

TRAINING COURSES

IICT conducts training programmes on specialized topics in the area of its activities

PUBLICATIONS

IICT publishes *IICT Bulletin* (Quarterly) and its annual reports

Contact Person Director, IICT

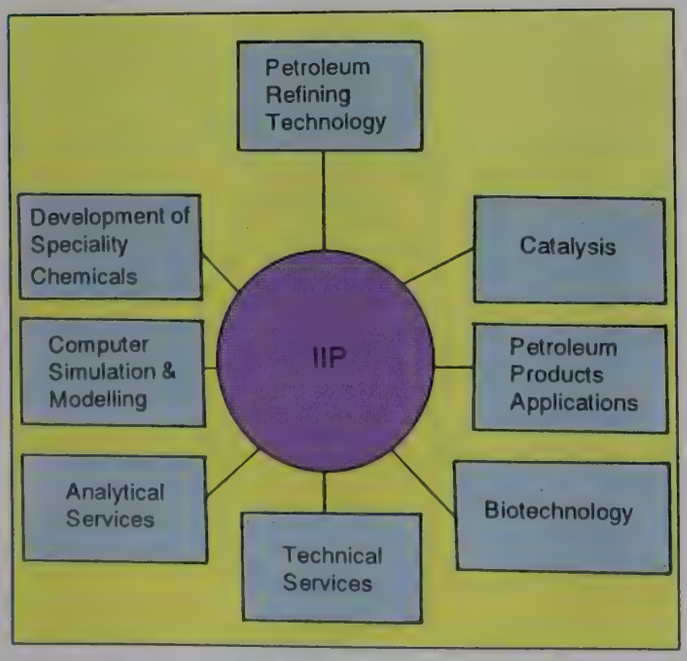
Indian Institute of Petroleum (IIP)

P.O. IIP, Mohkampur, Dehra Dun 248 005
Telephone: (0135) 24508 Telegram: PETRINST DEHRA DUN
Telex: 0585 217 IIP IN

Established: 1960
Director: Dr T.S.R. Prasada Rao, Ph.D.(Chem)
Budget for 1992-93: Rs 604 lakh

MANDATE

- To develop processes and products for petroleum refining and petrochemical industries
- To assist refineries in absorption, adoption and selection of technologies and optimization of unit operations
- To provide technical services, including crude evaluation to the petroleum industry
- To carry out R&D work on utilization of crude, its products, natural gas and petrochemicals
- To train personnel working in oil and petrochemical industry
- To assist the Bureau of Indian Standards in formulation of standards for petroleum products
- To conduct feasibility studies and market demand surveys of petroleum and related products



MAJOR R&D PROGRAMMES

The major R&D programmes of IIP relate to petroleum refining technology, development of separation processes, conversion processes, petroleum products applications, development of chemicals and biotechnology.

Separation Processes: Aromatic extraction, dewaxing/deoiling, lubes/bitumens, deasphalting and adsorptive separations

Conversion Processes: Catalytic reforming (SR & CCR), hydrotreating, hydrocracking, fluid catalytic cracking and resid cracking, visbreaking and delayed coking

Petroleum Products Applications: Alternative fuels, vehicular emissions, performance evaluation, conservation of fuels and lubricants, tribology, industrial burners, domestic appliances, waste disposal through incineration

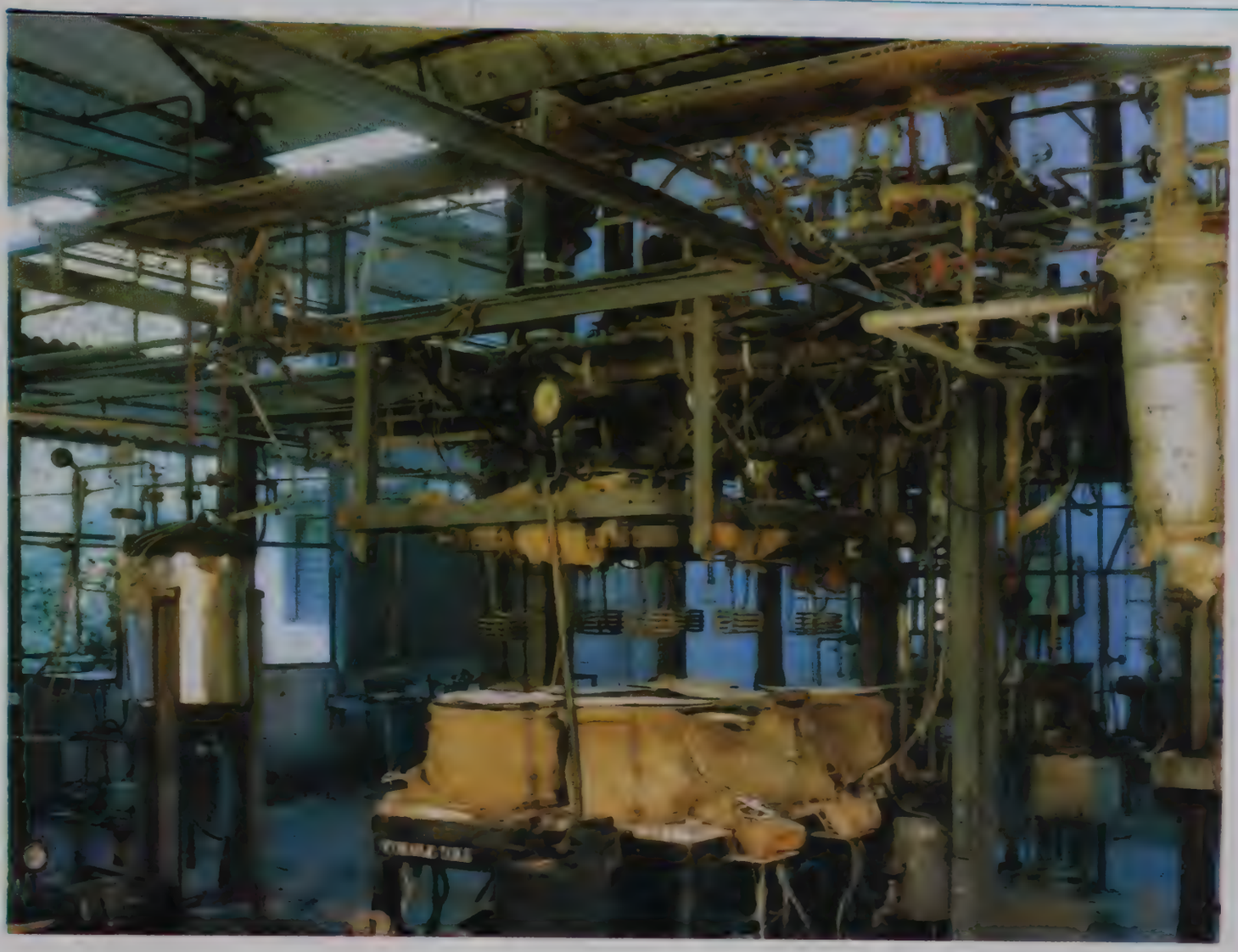
Chemical Sciences: Process development for additives & intermediates, speciality chemicals, chemicals from biomass and electrochemistry/corrosion

Biotechnology: Microbial enhanced oil recovery and microbial dewaxing

SIGNIFICANT ACHIEVEMENTS

- Solvent extraction processes have been developed for production of benzene and toluene, food grade

Delayed coking unit



Visbreaking pilot plant

hexane, aviation turbine fuel, lubricating oil base stocks, dewaxing/deoiling and deasphalting.

- Catalysts and processes have been developed for catalytic reforming, hydrogenation of pyrolysis gasoline and hydro-desulphurization of naphtha, kerosene and gas oil.
- A computer simulated model package has been developed for catalytic reforming process.
- Thermal conversion processes have been developed for soaker visbreaking and delayed coking.
- Use of alcohols has been investigated as alternative fuel in IC engines.
- A process of re-refining of used crankcase lubricating oil has been developed.
- A process for the production of hot rolling oil for steel mills has been developed.
- A kit has been developed for vehicles using methanol and diesel bifuel.
- Emissions of automotive vehicles have been studied.
- Processes have been developed for the production of speciality chemicals & additives like sulpholane, phenolic and amine antioxidants, polybutenes, etc.
- Fuel efficient industrial burner, LPG stove, kerosene wick stove, and improved hurricane lanterns and lamps have been developed.
- A process has been developed for the production of single cell proteins from normal paraffins.

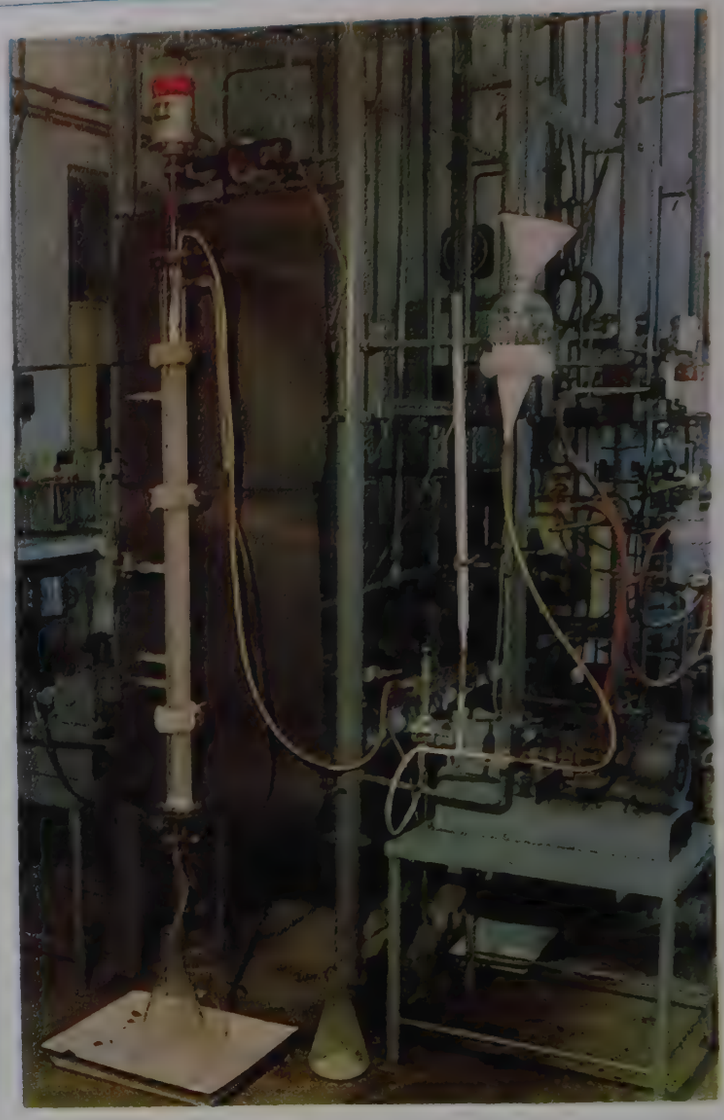
MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- IIP-IFP catalytic reforming (IOC, Haldia, Digboi, Barauni, Mathura and BRPL)
- IIP-IFP kerosene hydrodesulphurization (IOC, Haldia)
- IIP-IFP gas oil hydrodesulphurization (MRL, Madras)
- IIP-IFP pyrolysis gasoline hydrogenation (IPCL, Vadodara)
- IIP-IFP naphtha pretreater (HDS) (Zuari Agrochem, Goa; SPIC, Tuticorin; and IPCL, Vadodara)

- IIP-EIL aromatic extraction process for the production of benzene and toluene (BPCL, Bombay; CRL, Cochin)
- IIP-EIL food grade hexane process (BPCL, Bombay; MRL, Madras)
- IIP-IPCL bimetallic reforming catalyst (MRL, Madras; IPCL, Vadodara)
- Lube oil rerefining (65 firms)
- Di-tertiary-butyl para-cresol (Balmer Lawrie Ltd, Madras)
- Para-tertiary-butyl phenol (Balmer Lawrie Ltd, Madras)
- IIP-EIL delayed coking processes (BRPL, Bongaigaon)
- IIP-EIL dewaxing/deoiling process (revamping) (IOC, Haldia)
- LAP burner (five firms)
- Nutan wick stove (thirteen firms)
- IIP smoke meter (two firms)
- Hot rolling oil (Lubrizol India Ltd, Bombay)
- Dual fuel kit for diesel vehicles (GAPSEAL, Vadodra)
- Liquid paraffins/white oils (Tara Technical Oils, Lucknow)
- Ethanol dehydration catalyst for ethylene manufacture (Oxide India Ltd, Durgapur)
- Improved hurricane lantern (four firms)
- Sulpholane production (one firm)
- High temperature antioxidants (one firm)

TECHNOLOGIES READY FOR TRANSFER

- All those already commercialized
- Dearomatization of naphtha
- Pure nexane production
- SK/ATF through sulpholane extraction
- Aromatics extraction from Lube Oil Base Stock (LOBS)
- Deoxo catalyst
- Catalyst for dehydration of alcohols
- HDS catalyst for naphtha and kerosene
- Visbreaking (coil & soaker) of residues
- Lab kerosene burner.



Dearomatization of naphtha and kerosene using liquid membranes

PROCESSES DEVELOPED AT LAB/BENCH SCALE AND READY FOR COMMERCIALIZATION

- Amine type antioxidant
- Polymethyl methacrylate
- Styrene methyl methacrylate
- Styrene acrylonitrile
- Synthetic fatty acids from *n*-paraffins
- Lithium/aluminium complex greases
- Petroleum sulphonates.

MAJOR FUTURE PROGRAMMES

The future programmes of IIP will be directed towards the development of petroleum refining processes, catalysis, speciality chemicals, fuel quality & emission studies, alternative sources of hydrocarbons, development of fuel-efficient industrial & domestic appliances and microbial enhanced recovery of oil.

Liquid nitrogen plant

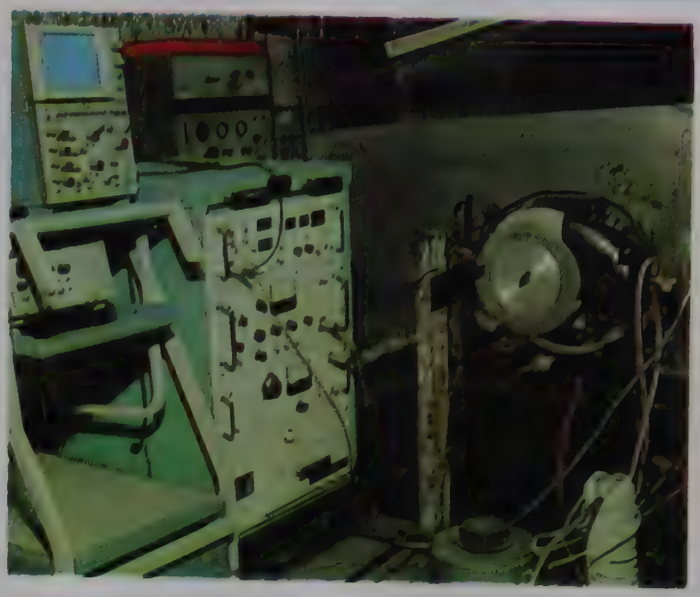
MAIN FACILITIES

Pilot Plants: Dewaxing/deoiling, visbreaking, delayed coking, propane deasphalting, 2" dia Old Rushton Column, rotating disc columns, high pressure equilibrium still, catalytic reforming, hydrocracking, glass lined 30 litre capacity reactor, antoclaves of various capacities, bench scale fermentor, micro reactor.

Analytical Facilities: Bench scale units for hydroprocessing, MAT unit for FCC catalysts, facilities for hydrocarbon analysis, facilities for catalyst characterization, facilities for petroleum products evaluation, facilities for crude evaluation, combustion chambers, incinerators, exhaust gas analyzer and anemometers for industrial and domestic appliances studies

SERVICES OFFERED

- Process & product developmental work for petroleum refining, petrochemicals, additives and speciality chemicals
- Technical services and trouble shooting operations for hydrocarbon industry



Set-up for cylinder gas sampling in IC engines

- Development of proprietary catalysts
- Physico-chemical characterization and evaluation of catalysts for reforming, hydrocracking, hydrodesulphurization, hydrogenation, FCC, etc.
- Evaluation of crudes and products
- Physico-chemical characterization of crudes, products and speciality chemicals
- Chemical composition of various products by sophisticated instrumental analytical techniques like GC, mass, UV, IR, NMR, X- ray diffraction, atomic absorption and emission
- Computer simulation and modelling

TRAINING COURSES

The laboratory conducts sponsored courses for oil and petrochemical industry. It has already trained more than 1800 engineers, chemists and technicians for industry.

PUBLICATIONS

The laboratory publishes a quarterly R&D Newsletter and its annual reports.

Contact Person: Director, IIP

FIELD STATIONS

The laboratory has a small group working on market surveys and techno-economic feasibility studies located at New Delhi:

Indian Institute of Petroleum
CSIR Complex, NPL Campus
Pusa
New Delhi 110 012

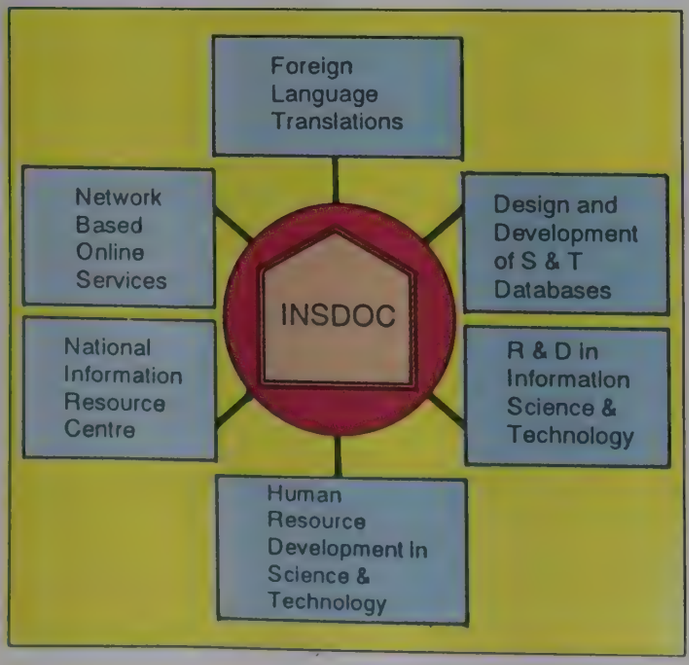
Indian National Scientific Documentation Centre (INSDOC)

14, Satsang Vihar Marg, New Delhi 110 067
Telephone: 665837, 6863617, 660143, 6863759 Telegram: INSDOC NEW DELHI
Telex: 031-73099 FAX : 91-11-6862228
E.Mail: teevee @ sirnetd.ernet. in

Established: 1952
Director: Prof. T. Viswanathan, Ph.D. (U.K.)
Budget for 1992-93: Rs 322 lakh

MANDATE

- To develop collections of sources of information in different fields of science and technology
- To render information services to S & T community in the field of science and technology
- To develop appropriate linkages with the information systems and services organized in India and abroad and to provide access to databases
- To act as a national repository of entire S & T information generated in the country
- To carry out R & D in information science and technology
- To develop trained manpower for undertaking advanced level tasks in the field of information science and services
- To adopt and promote appropriate technologies and management practices for increasing productivity of information networks and services in the country


Foreign Language Translations
Network Based Online Services
Design and Development of S & T Databases
INSDOC
National Information Resource Centre
R & D in Information Science & Technology
Human Resource Development in Science & Technology

MAJOR R & D PROGRAMMES

The R & D programmes of INSDOC focus on deep systems analysis and software development for automating information services and library functions. The main R & D programmes are: (i) design and development of S & T databases, (ii) network-based online services, (iii) R & D in information science and technology, (iv) foreign language translations; and (v) human resource development in information science and technology.

SIGNIFICANT ACHIEVEMENTS

- INSDOC is functioning as a repository of the S&T information generated in the country. All the Indian S & T periodicals and the important Indian S & T books are being procured by the Centre.
- INSDOC publishes *Indian Science Abstracts* (ISA) (fortnightly) which contains abstracts & research papers published in about 1000-1200 Indian S & T publications, in addition to information on patents, standards and theses. It also covers papers published by Indian scientists in foreign journals.
- A computerized communication network (SIRNET) has been established among R & D organizations for fast E-mail and data transfer. The number of R&D organizations joining the SIRNET is increasing at a rapid rate.
- An online search facility from international and indigenous databases has been established. Some of the indigenous databases available for search are: *National Union Catalogue of Scientific Serials in India* (NUCSSI), *Indian Serials Contents on Multi-Media* (ISCOMM), *Polymer Science Literature, Metallurgy Database, Database on Indian Patents* (INPAT), *Medicinal & Aromatic Plants Abstracts Database* (MAPA), *Database on Indian Experts* and *BIS Database*.
- A new service, Contents, Abstracts and Photocopies Service (CAPS), based on a set of 5000 S & T periodicals, has been started in order to fill the gap created by a sharp reduction in the availability of foreign periodicals to Indian S & T community.

- Electronic imaging has been set up as a modern archival alternative to microfilming, etc.
- Expertise has been developed to undertake on a turn-key basis the design, establishment and modernization of library and information centres of other organizations. Design and development of information databases are also undertaken for other organizations.

MAJOR FUTURE PROGRAMMES

INSDOC, has identified the following four major programmes as thrust areas for the next few years:

National Information Resource Centre: INSDOC will strengthen its information resource base by acquiring important foreign core periodicals for supporting a fast document delivery system.

Network based online services: It is planned to network about 1000 R&D organizations through SIRNET for quick E-mail service and data communication. Online search from databases will be started from different parts of the country.

Turn-key projects in library automation and information databases: INSDOC will strengthen its expertise in the latest aspects of library and information automation. A number of organizations are requesting INSDOC to design, computerise, automate and modernize their library and information centres on turn-key basis.

R&D in information science and technology: INSDOC will further strengthen its R&D programmes in information

Computerised information system in operation at INSDOC

science and technology specially on networking, electronic imaging, CD-ROM technology, software engineering, computer communication, etc.

MAIN FACILITIES

- Networking and electronic-mail
- Online database host system
- National Science Library
- Reprography
- DTP and offset printing
- Electronic imaging for archival purposes

SERVICES OFFERED

- Document copy supply & bibliographic services
- Literature search from international databases
- Foreign language translation/interpretation
- Retrospective conversion of catalogue or library catalogue management
- Contents, Abstracts, Photocopies Service (CAPS)
- Microfilming & slide-making
- Desk top publishing
- Compilation of databases and directories
- Electronic imaging of archival records
- Electronic mail service

TRAINING COURSES

INSDOC conducts an advanced two-year post-graduate course in the field of information science, viz., Associateship in Information Science. INSDOC also organizes a number of short-term training courses on topics like computer applications to library and information activities, CDS/ISIS, bibliometrics, information technology, online information retrieval, database management systems and UNIX.

PUBLICATIONS

- *Indian Science Abstracts* (semi-monthly)
- *Annals of Library Science and Documentation* (quarterly)
- *CSIR Research Output* (annual)

Contact Person: Director, INSDOC

FIELD STATIONS

INSDOC Regional Centre
c/o Indian Institute of Science
Bangalore 560 012
Telegram: CARE SCIENCE
Telephone: 343 554

INSDOC Regional Centre
Indian Institute of Chemical Biology
4. Raja S.C. Mullick Road
Calcutta 700 032
Telegram: CARE LIVINGCELL
Telephone: 424883

INSDOC Regional Centre
CSIR Complex, Adyar
Madras 600 020
Telegram: CARE CONSEARCH
Telephone: 411 453

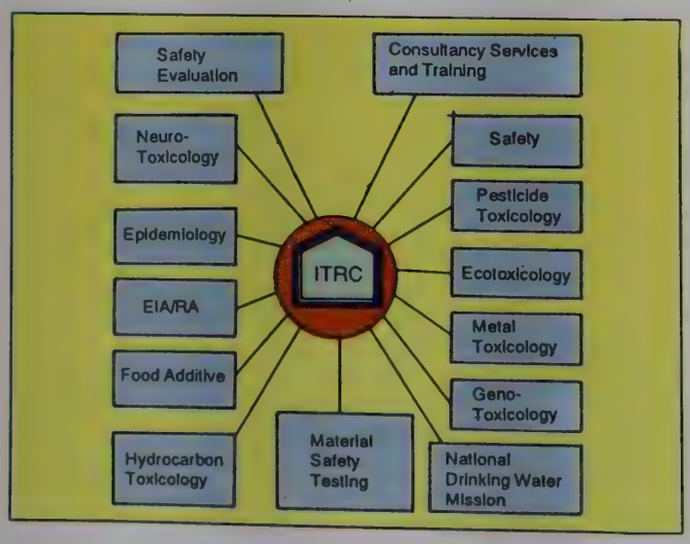
Industrial Toxicology Research Centre (ITRC)

Mahatma Gandhi Marg, Post Box No. 80, Lucknow 226 001
Telephone: 248227, 240106 Telegram: INTOXI LUCKNOW
Telex: 0535-456 ITRC IN FAX: 91-522-248227

Established: 1965
Director: Dr R.C. Srimal, M.D.
Budget for 1992-93: Rs 360 lakh

MANDATE

- Identifying, through systematic epidemiological surveys, the health hazards to which industrial and agricultural workers are exposed in their work environment
- Undertaking safety evaluation of the chemicals used in industry, agriculture and day-to-day life; studying mode of action of chemical pollutants, developing suitable diagnostic tests and suggesting remedial/preventive measures
- Collection and dissemination of information on hazardous chemicals
- Providing consultancy and guidance on toxicological matters to government agencies as well as industries
- Interaction with international organizations such as WHO, FAO, UNEP, UNDP, IRPTC and IPCS as a national correspondent on toxicological matters



MAJOR R & D PROGRAMMES

The major areas of research of ITRC relate to neurotoxicology, environmental health, ecotoxicology, phototoxicology, phytotoxicology, epidemiology, immunotoxicology, developmental toxicology, cardiovascular toxicology, pulmonary toxicology, environmental carcinogenesis, environmental monitoring and environmental biotechnology.

In-depth toxicological research is carried out on priority chemicals such as heavy metals, industrial dusts and fibres, plastics and polymers, hydrocarbons, pesticides, detergents, dyes and food additives.

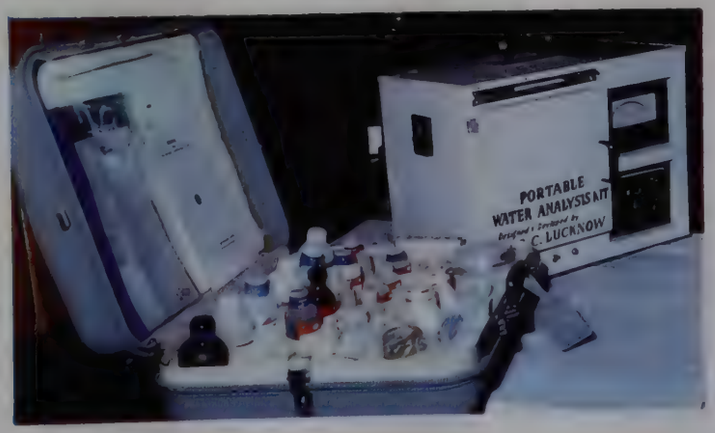
SIGNIFICANT ACHIEVEMENTS

- Chronic exposure of treated malnourished animals to hexachlorocyclohexane (HCH), one of the pesticides largely used in India, has been shown to enhance cardiotoxicity and immunosuppression.
- Supplementation with vitamin E has been found to prevent cadmium induced changes in early locomotor activity and oxidative damage to the brain.
- To evaluate the toxicity of neurotoxicants a neurotransmitter receptor binding screen has been developed using high affinity radioligand binding assay.
- The cytotoxic and fibrogenic responses of industrial dusts and fibres like silica, mica, kaolin, talc, asbestos have been studied in detail and their pathogenic mechanisms elucidated.
- Considerable new fundamental information has been obtained regarding extra-hepatic and extra-microsomal biotransformations such as AHH induction in lungs, skin and brain. MFO activity has been detected in brain mitochondria.
- The bacterial glycoprotein 'protein A' has been found to abrogate the toxicity of some industrial chemicals including carcinogens.
- Vitamin B complex supplementation has been found to diminish susceptibility to lead and cadmium intoxication.
- Protocols for testing tumour initiating and promoting potentials of chemicals have been developed.
- Tumour promoting and tumour initiating capacity and complete carcinogenicity of mancozeb, a commonly used fungicide, has been detected.
- Immunotherapy given at ITRC has been shown to significantly improve the symptomatology and lung function in hemp workers.

- A major programme on the evaluation of magnitude and usage pattern of artificial synthetic colours in food stuffs has been undertaken.
- A paralytic disease affecting the lower limbs was detected in a large number of residents of villages around Unnao, U.P., investigated and the cause identified.
- Ascorbic acid administration has been found beneficial in protecting workers against skin lesions due to benzanthrone.
- Dermal toxicity of synthetic detergents has been evaluated and national standards for consumer safety protection and test protocols have been developed.
- The role of active oxygen species in the toxicity of many toxicants like aniline, ether and detergents and the mechanism of antioxidants defence have been studied.
- The chances of enhanced dermal toxicity under Indian conditions due to photochemical activation have been assessed based on a survey of a large number of pesticides and dyes.
- ITRC has contributed significantly to the following National/Societal Missions: Drinking Water Mission, Ganga Action Plan, Global Climatic Change Programme and All India Coordinated Programmes on Pesticide and Metal Exposure Assessment
- The institute has taken up industry-oriented programmes relating to: epidemiology, environmental monitoring, occupational health, safety evaluation of industrial/environmental chemicals, environmental impact assessment/risk assessment, chemical disaster preparedness and follow-up.
- Aquatic ecotoxicological studies on water resources management have been carried out.

MAJOR TECHNOLOGIES TRANSFERRED

- Amrit Kumbh — a low cost water purification device (M/s Shipra Scientific Traders, Lucknow).
- Portable water analysis kit: (M/s Jain Scientific Glass Work, Ambala Cantt., Mathbin Scientific Agencies, New Delhi; Gopi and Gopi Scientific Agencies, Kakinada; and FABCOS Engineers, Lucknow).



Portable water analysis kit developed at ITRC

MAJOR FUTURE PROGRAMMES

- Establishment of national facility for safety evaluation
- Establishment of poison control centre
- Development of biotechnology for environmental decontamination
- Development of alternative methods for safety evaluation
- Study of molecular mechanisms and development of intervention strategies in neurotoxicology

MAIN FACILITIES

- Facilities for safety evaluation of chemicals, materials
- Animal House (animal breeding and maintenance facilities)
- Library, computerized database, technical query-answering services
- Modern instrumentation facilities for analytical toxicology
- Waste Water Analysis Laboratory

SERVICES OFFERED

Industrial consultancy services are provided regarding consumer safety evaluation of plastics, stainless steel containers, detergents and their dermal safety evaluation, biodegradability and ecofriendliness. Specific technical queries are also answered.

TRAINING COURSES

ITRC conducts training courses in the areas of its specialization, e.g., water quality assessment.

PUBLICATIONS

- *Industrial Toxicology Bulletin*
- *Current Literature in Toxicology with Abstracts*
- Toxicity testing protocols
- Toxicity Data Handbook Series
- *Toxicology Atlas*

Contact Person : Director, ITRC

FIELD STATIONS

ITRC Gheru Campus,
Gheru,
Lucknow-Kanpur Road,
Lucknow
Telephone: 53843, 51077

ITRC Occupational Health Centre,
Pandu Nagar,
Kanpur,
Telephone: 217646

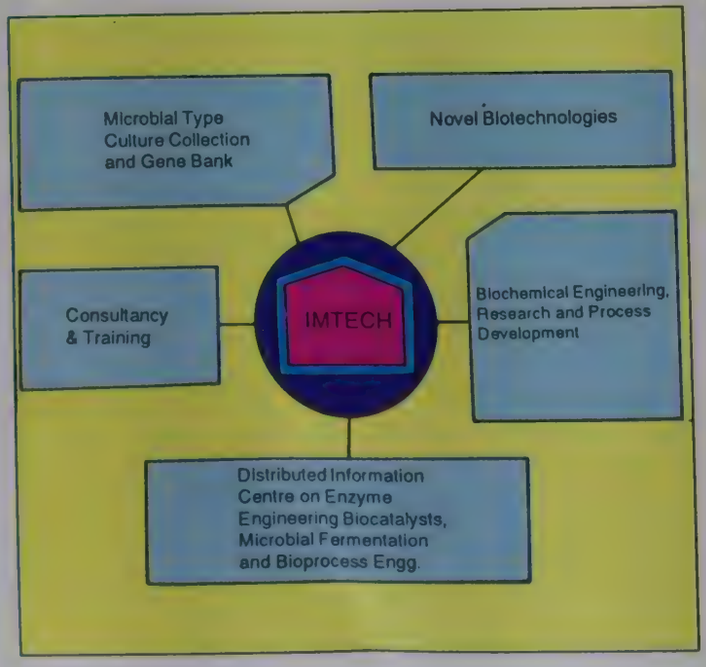
Institute of Microbial Technology (IMTECH)

Post Box No. 1304, Sector 39-A, Chandigarh 160 014
Telephone: 45108, 45004, 44252, 44285 Telegram: IMTECH CHANDIGARH
Telex: 0395-369 IMT IN
E.Mail: root%imtech@sirnetd.ernet.in

Established: 1984
Director: Dr C.M. Gupta, Ph.D., F.N.A., F.A.Sc., F.N.A.Sc.
Budget for 1992-93: Rs 407 lakh (RE)

MANDATE

- To provide an integrated research, development and design base for microbial technology
- To undertake basic and applied research and development programmes in established and newly emerging areas of biotechnology including genetic engineering
- To develop and maintain gene pool resources and genetic stocks of microbial cultures and other cell lines
- To establish facilities for design of process equipment and bio-reactors
- To impart training in microbiology, microbial technology and biochemical engineering to research workers and technologists
- To establish and maintain effective linkages with industry and educational institutions, develop capabilities for producing design and engineering packages for industrial plants and to undertake contract work on research and development in the area of biotechnology


Microbial Type Culture Collection and Gene Bank
Novel Biotechnologies
Consultancy & Training
IMTECH
Biochemical Engineering, Research and Process Development
Distributed Information Centre on Enzyme Engineering Biocatalysts, Microbial Fermentation and Bioprocess Engg.

MAJOR R&D PROGRAMMES

The institute carries out application-oriented R&D in the frontier areas of biotechnology with the short-term objective of capability generation and a long-term perspective of generating newer leads in the critical areas of its working. Most of the research programmes deal with the application of newer tools of molecular biology and genetic engineering to develop new technologies or improving upon the existing ones vital to our national needs. The institute is currently carrying out R&D programmes in the following areas: molecular biology and microbial genetics, animal cell/tissue culture, protein engineering and separation technology.

SIGNIFICANT ACHIEVEMENTS

- Development of a process for the efficient conversion of molasses to alcohol using an osmotolerant and ethanol-tolerant strain of yeast
- Development of knowhow for enzymatic conversion of rifamycin B to rifamycin S
- Development of a simplified process for purification of urokinase from urine, based on antiurokinase monoclonal antibodies
- Development of a new targeting rationale for selective delivery of drugs to macrophages utilizing the exquisite specificity and high efficiency of the process of endocytosis mediated by receptors present exclusively on the cells of macrophage lineage. This provides a generalized method for manipulating the metabolic activity of macrophages for a variety of purposes and is likely to find application in the therapy of diseases in which macrophages are involved such as leishmaniasis, tuberculosis, leprosy, rheumatoid arthritis as well as some neoplastic diseases.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Fermentative production of ethanol from an improved strain of *Saccharomyces cerevisiae*
- Enzymatic conversion of rifamycin B to rifamycin S

MAJOR FUTURE PROGRAMMES

The institute will augment its R&D programmes in the areas of molecular biology/microbial genetics, animal cell/tissue culture, protein engineering and separation technology.

MAIN FACILITIES

Research Facilities

- Scanning & transmission electron microscopes
- Ultra and superspeed centrifuges
- HPLC/FPLC and gas chromatograph

1500 - litre fermentation pilot plant

- Amino acid analyzer
- Protein sequencer & protein synthesizer
- Fermentation pilot plant (1500 litre) and associated down stream processing equipment
- Microvax II computer system
- Modern facilities for identification, preservation and maintenance of microorganisms

National Facilities

The Department of Biotechnology and CSIR have entrusted IMTECH with the creation of three major national facilities:

- **Biochemical Engineering Research & Process Development Centre (BERPDC)**: The objective of this national facility is to help develop microbial processes up to industrial scale for useful products. The Centre has several laboratory scale fermenters, a 150 litre fermenter and a computer-controlled 1500 litre fermentation pilot plant. The plant, only one of its kind in India, is integrated upstream with media preparation vessels and downstream with a centrifugal separator and a cell homogenizer. Within the plant are also housed two other fermenters, of 15 litre and 150 litre capacities, to enable thorough scale-up studies.
- **Microbial Type Culture Collection & Gene Bank (MTCC)**: It is a well equipped modern facility whose main objectives are to act as a depository and to supply authentic microbial cultures, and to provide related services to scientists working in research institutions, universities and industries. At present, it has five sections, namely, actinomycetes, bacteria, fungi, yeasts and plasmids. Relevant information about the strains held in MTCC is computerized for easy search, analysis and retrieval.
- **Distributed Information Centre on Enzyme Engineering, Immobilized Biocatalysts, Microbial Fermentation and Bioprocess Engineering (DIC)**: IMTECH has been entrusted with setting up and running of DIC as a part of the Biotechnology Information System (BTIS) of the Department of Biotechnology. Its aim is to interlink all the specialized centres through a national bio-information network. A Microvax II computer system has been set-up to create and build up databases for the benefit of researchers involved in R&D and manufacturing activities in the area of biotechnology. A Micro Earth Station for linking the Centre with NICNET via satellite has been commissioned and is operational.

SERVICES OFFERED

The institute undertakes contract work for development of microbial processes for useful products. Intensive efforts are continuously made to evolve R&D programmes in consultation with and under the sponsorship of industrial concerns. IMTECH's clients include ONGC, IDPL, Themis Chemicals, Ranbaxy, Unichem, Lupin, Vittal Mallya Scientific Research Foundation and Godrej Soaps.

TRAINING COURSES

IMTECH has established close linkages with various academic and research institutions and is conducting many courses, such as:

- Two-year M.Sc. (Biotechnology) programme has been started in collaboration with Panjab University, Chandigarh.
- Summer training is provided to M.Sc. (Biotechnology) students from various universities upon request.
- Intensive short-term training courses are organized periodically on various aspects of biotechnology. Courses have been organized in genetic manipulations, separation techniques, molecular genetics of yeast, molecular genetics of streptomyces, selective isolation and identification of actinomyces and modern analytical approaches to the development of fermentation processes.

PUBLICATIONS

The institute publishes its annual reports.

Contact Person: Dr Naresh Kumar, Scientist, IMTECH.

National Aerospace Laboratories (NAL)

PB 1779, Bangalore 560 017
Telephone: 080-570584, 565579 Telegram: NAEROLAB BANGALORE
Telex: 0845-2279 NAL IN
E.Mail: root @ sirnetb. iisc. ernet. in FAX: 560862, 570670

Established: 1959
Acting Director: Dr K.N. Raju, Ph.D.
Budget for 1992-93: Rs 2991 lakh

MANDATE

- To carry out R&D work in aerospace engineering and related areas with a view to applying the knowledge to design, construction and operation of aircraft
- To maintain and operate important facilities, e.g., National Trisonic Aerodynamic Facility (NTAF), full-scale fatigue testing facility, acoustic test facility and vibration test and analysis facility
- To undertake consultancy/contract work on design/development and testing of aircraft, etc.
- To serve as repository of scientific knowledge in the fields of aeronautics and aerospace

MAJOR R & D PROGRAMMES

The major R&D programmes of NAL relate to aerospace electronics and systems, fluid dynamics, aerodynamics, flight experiments, flight mechanics and control, materials science, propulsion, structural engineering and wind energy.

The institute is actively engaged in the design and development of light combat aircraft (LCA) and light transport aircraft (LTA). The institute is also developing a two-place trainer aircraft (NALLA).

Two-seater trainer aircraft, NALLA, under fabrication

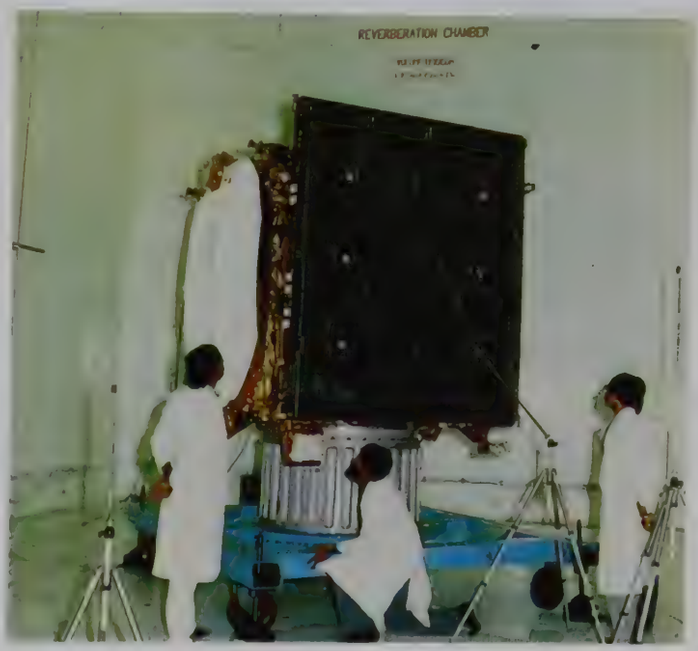
Some of the other important R&D programmes being pursued at NAL relate to flight data read out and analysis, high density acoustics, sensor technology, modelling of fluid flows, turbulent and transitional flows, flow structure and management, aircraft and missile aerodynamics, aircraft parameter estimation, flight simulation, wind tunnel simulation, development of special materials like fibres and composites, advanced structural ceramics, turbomachinery, computer-aided design and machining, composite structures, fatigue and fractures.

SIGNIFICANT ACHIEVEMENTS

- Development of a light all-fibre glass aircraft of Rutan Long Ez Canard design, a research aircraft for flight experimentation to try out new technologies such as fly-by-wire controls
- Development of a large number of computer codes to handle a variety of problems in heat transfer, fluid flow and stress analysis which are being extensively used by agencies like DRDO, HAL and ISRO for their aerospace and missile development programmes
- Development of sunshield panels for passive radiation cooling of very high resolution radiometer (VHAR) in the Indian satellite INSAT-2A
- Acoustic environment validation testing of INSAT-2A

Mach number distribution around an aerofoil, and surface pressure over a satellite launch vehicle generated by flosolver

- Development of readout facilities for the DRFD/QAR for all aircraft used by India's national carriers (resulting in a very significant foreign exchange saving) and of novel techniques for cockpit voice recorder data analysis
- Development of Flosolver Mk3, India's first parallel computer offering a sustained computing speed of 50 Mflops; for analysis of flow past complex three-dimensional bodies (aircraft, satellite launch vehicle) and for direct numerical simulation of the Navier Stokes equations
- Development of aramid fibres, fibre reinforced Al-Li-alloy laminates and carbon fibre reinforced plastic rudder for military and civil aircraft
- Development of electrochemical machining equipment for making nozzle rings, a component of turbocharger of diesel locomotives
- Development of a process for heavy nickel plating of seal discs of nuclear reactors, an effort which has already resulted in foreign exchange savings of about Rs 120 million
- Development of NALSUN, a new low-cost black chromium plating process which has been transferred to six industries so far; patents obtained in India, USA, Australia and Europe.
- Agreement with Taneja Aerospace and Aviation Limited for the joint development of the two-place NALLA



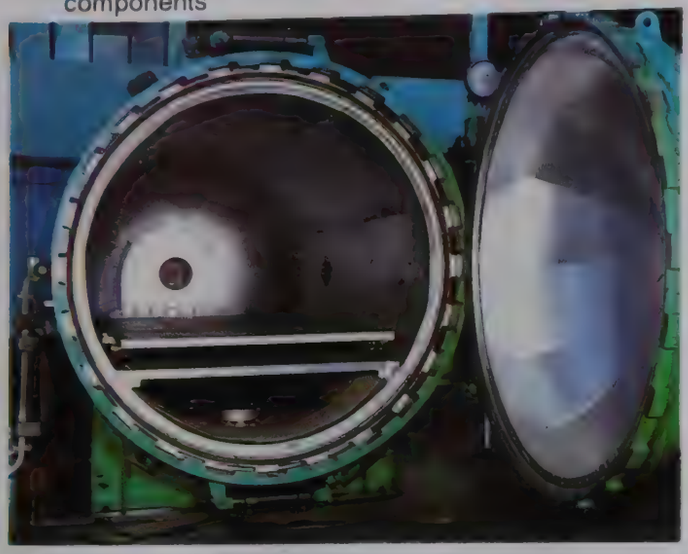
INSAT-2A flight model at acoustic test facility

- Winning an international (UK) contract for aircraft and helicopter wake vortex modelling

TECHNOLOGIES READY FOR TRANSFER

- Ultra-high-speed tin plating bath for manufacture of the plated wire used in resistors and capacitors

- Black chromium plating bath for plating solar stills
- Process for preparation of chromium dioxide powder used in magnetic recording tapes for audio, video, instrumentation and computer applications
- Process for descaling of diesel locomotive engine components



NAL's indigenously designed autoclave facility

- 3D coordinate measuring machine for measurement and inspection of engineering components
- Semi-automatic buffing machine
- Technology for production of autoclaves

Heat shield of an ISRO launch vehicle undergoing tests at the ATF

- Flosolver-parallel processing computer
- Automatic visual range assessor (AVRA) for monitoring visibility of airports and highways
- Electrochemical machine equipment
- Electrochemically-assisted arc machine for cutting billets barstocks, etc.
- AC/DC harmonic/pulse polarographs
- Wind powered battery charger for battery charging applications in remote areas

MAJOR FUTURE PROGRAMMES

The R & D efforts of NAL will continue to focus on the development of LCA, LTA and NALLA and similar other programmes contributing to the country's endeavour for self-reliance in the field of aerospace science and technology. ATF and NTAF will be used for carrying out tests on IRS-IE, heat-shields of ASLV, PSLV, GSLV, INSAT-IB and IRS-2C.

MAIN FACILITIES

- National Trisonic Aerodynamic Facilities (NTAF) with three wind tunnels (1.2m, 0.6m and 0.3m). NTAF, which is celebrating its silver jubilee this year, continues to be the only one of its kind in the country and is extensively used in all the national aerospace projects for aircraft, missiles and satellite launch vehicles.
- Full-scale Fatigue Test Facility with additional loading channels, a six-actuator component fatigue testing facility and a new material fatigue evaluation laboratory. This facility is being extensively used in the development of the LCA.
- Acoustic Test Facility, with a reverberation chamber of 1100 cu.m. It completed its 1000th blowdown in

EE Pod undergoing vibration test

Ground vibration testing of the HS 748 aircraft with pylon at NAL, Bangalore

March 1992. The facility, which is now almost seven years old is financially self-sufficient

- An advanced Composite Structures Laboratory with all the necessary infrastructure (waterjet cutter, preprog cutting machine, c-scan facility, clean room, etc.) A large autoclave (2.4 m diameter, 6m length), capable of applying 7 bar pressure at 200 °C is also available.
- Facilities for scientific computing: C-MMACS offers a large variety of platforms for mathematical modelling and computer simulation, and Flosolver Mk 3.07 offers sustained computing speeds of over 50 Mflops.
- NISSAT Access Centre for International Databases (NACID)

SERVICES OFFERED

NAL can offer a variety of aerospace-related services:

- Aerospace vehicle aerodynamics
- Design and fabrication of complex wind tunnels using advanced composites
- Wind tunnel testing of aerospace vehicles
- Ground violation testing of full airframe structures
- Testing of aerospace structures in the Acoustic Test Facility
- Software for computational fluid dynamics (on sequential and nominal machines)
- Evaluation of materials for fatigue and fracture
- Evaluation of structural integrity of airframes and other structural components
- Testing and optimization of compressor and turbine blade profiles using cascade tunnel
- Development of composite materials
- Failure analysis and accident investigation

TRAINING PROGRAMMES

The institute offers the NAI-UNI Lecture Series which features course work, case studies, practical demonstrations and tutorials in different areas of aerospace research. NAL also offers several schemes for graduate and diploma trainees, project students, apprentices, etc.

PUBLICATIONS

NAL publishes an annual report, a quarterly newsletter (*NAL News*) and a weekly calendar of events. NAL also brings out five categories of internal publications/reports (250-300 titles every year).

Contact Person: Director, NAL

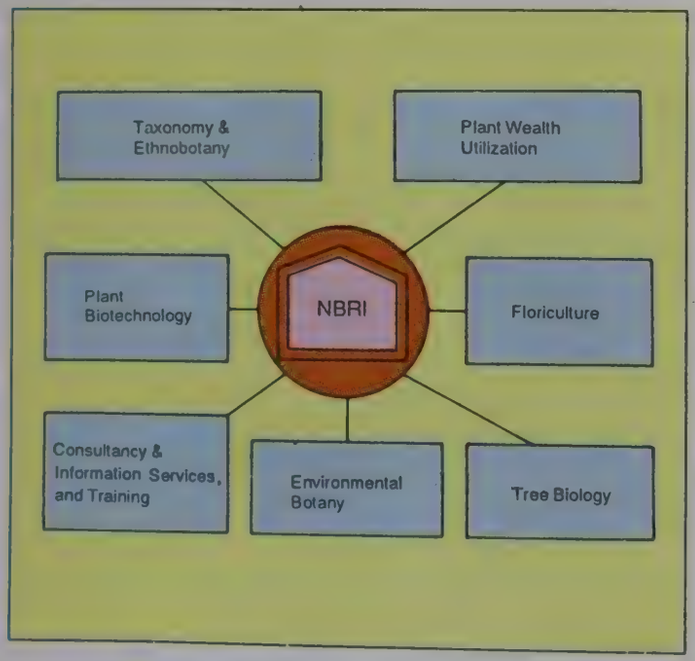
National Botanical Research Institute (NBRI)

Rana Pratap Marg, Lucknow 226 001
Telephone: 236431-35, 249588, 248021, 245240 Telegram: BAGH, LUCKNOW
Telex: 0535-315 NBG IN FAX : 0522-244330

Taken over : 1953
Director : Dr P.V. Sane, M.Sc. (Ag.), Ph.D. (Alberta, Canada), FNA
Budget for 1992-93 : Rs 438 lakh

MANDATE

- To carry out R&D on the conservation, improvement and exploitation of the plants of economic and ornamental value, other than the traditionally cultivated ones
- To develop production technologies for new plant sources of commercial importance
- To build up germplasm collection of economic plants
- To provide expertise for identification, supply and exchange of plants and propagules, garden layout and landscaping
- To collect and disseminate scientific and technical information relating to plants of economic and ornamental value



MAJOR R & D PROGRAMMES

The major R&D programmes of NBRI relate to the plant biotechnology, floriculture, tree biology, plant wealth utilization, environmental sciences and taxonomy & ethnobotany. Basic research in the area of plant molecular biology forms an important part of the overall programme of the laboratory.

SIGNIFICANT ACHIEVEMENTS

- Development of more than 180 new ornamental cultivars
- Dehydration of fresh flowers and foliage and their employment in floral arts & crafts
- Rapid mass propagation of medicinal, economic as well as ornamental plants through tissue culture
- New techniques for cultivation and training of chrysanthemum
- Technology for *usar* land reclamation
- Production of woody biomass on sub-standard soil

'Amar Summerking' — a new cultivar of *Amaranthus*

- Field distillation unit for rose oil and a new apparatus for distillation of perfumed water and *attar*
- Production, in sewage, of *Spirulina platensis*, a protein rich blue-green alga, for animal and poultry feed
- High yielding and better adaptable strains of opium poppy, *Papaver somniferum*
- Development of new Amaranthus cultivars for grains, vegetables and ornamentals
- Botanical authentication of about 94 indigenous herbal drugs and standardization of about 74 *Unani* compound formulations
- Extraction of industrial gum from 'Dhaincha', *Sesbania aculeata*.
- Cultivation of German Chamomile, *Chamomilla recutita* on marginal soils
- Agrotechnology for improved cultivation and disease control of betelvine

Betelvine (*Piper betle* L.) c.v. 'Desawari' under cultivation at Betelvine Research Centre, Mahoba

- Inventories on plants of ethnobotanical importance used by tribals
- Identification of pollution-tolerant/resistant and dust-trapping plant species, and aquatic plants as bioindicators of heavy metal pollution
- Basic studies on plant metabolism and the role of calcium and calmodulin in regulating enzymes of nitrogen metabolism
- Introduction of Poplar cultivation in marginal lands
- Setting up of databases on economic plants and providing cumulative services

MAJOR FUTURE PROGRAMMES

The major future programmes of NBRI will focus on developing technologies based on plant molecular biology and genetic engineering. It is planned to introduce single gene regulated traits in plants using the technologies of recombinant DNA and genetic engineering. It is also proposed to develop computer- based information technology, to computerize the institute's herbarium sheets and to build up a legume database for South-East Asia. R&D work will be extended to commercially viable ornamentals.

MAIN FACILITIES

- A wide range of modern sophisticated equipment/instruments for carrying out work in photosynthesis, biochemistry, molecular biology and plant tissue culture
- Several testing and evaluation facilties, e.g., irradiation of plants and plant material with gamma rays, plant identification, estimation and analysis of plant materials for proteins, amino acids, oils, fats, active medicinal principles, gums, mucilages.
- Pharmacognostical analysis of herbal drug formulations
- Computer facilities with databases on economic plants, a herbarium and a botanical library

SERVICES OFFERED

NBRI offers consultancy service to industry/government organizations in garden layout and landscaping and in many other areas of its expertise. The institute supplies plant materials of economic value. The institute also provides several analytical and testing services. The Economic Botany Information Service (EBIS) covers selective dissemination of information (SDI), technical enquiries, bibliography, reprography and current awareness services (*Applied Botany Abstracts, Current Research in Plant Science*), and a quick access information system for mass media.

TRAINING COURSES

The institute provides short-term training courses in cultivation and training of ornamentals and the latest techniques in horticultural practices. Training courses are also arranged on plant tissue culture, floral craft and indigenous herbal formulations.

PUBLICATIONS

The institute publishes *NBRI News Letter* (Quarterly), *Applied Botany Abstracts* (Quarterly), its annual reports and extension bulletins and folders in English, Hindi and Urdu; bibliographies, manuals, survey reports, reviews and proceedings.

Contact Person: Shri A.K. Srivastava, Scientist-in-Charge, EBIS & Information and Library.

FIELD STATIONS

Banthra Research Station and Biomass Research Centre,
Kanpur Road, Banthra.
District Lucknow, U.P. 227 101

NBRI Betelvine Extension Centre,
Mahoba, Distt. Hamirpur, U.P. 210 427

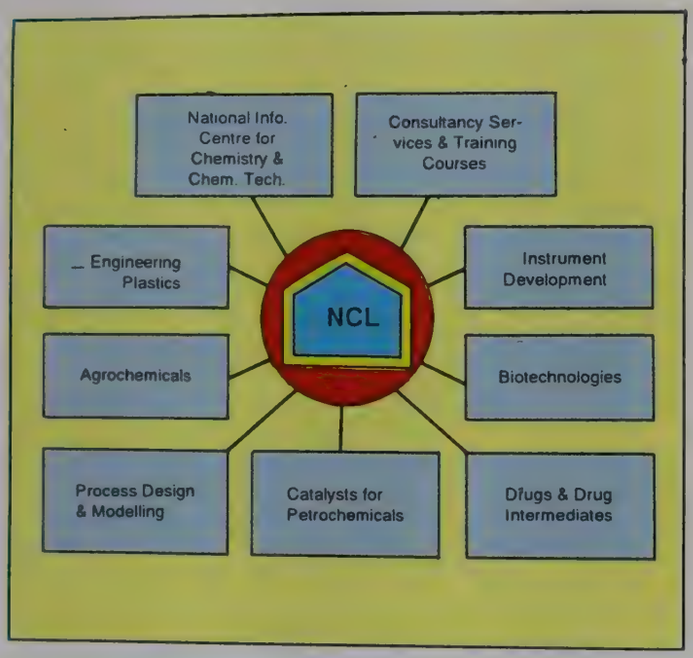
National Chemical Laboratory (NCL)

Pune 411 008
Telephone: 331453, 336451 & 336452 Telegram: CHEMISTRY PUNE
Telex: 0145-7266, 0145-7586 & 0145-7633 NCL IN FAX: (0212)330233 & (0212)334761
E.Mail: root @ ncl.ernet.in

Established: 1950
Director: Dr R.A. Mashelkar, B Chem. Engg., Ph.D.
Budget for 1992-93: Rs 1555 lakh (estimate)

MANDATE

- To conduct research in different areas of chemistry
- To develop new technologies for gainful utilization of natural resources of the country
- To develop technologies in high-tech areas with a view to providing import substitution and increasing export potential
- To assist the chemical industry through consultancy, contract research, training, etc.



MAJOR R & D PROGRAMMES

The major R&D programmes of NCL relate to the areas of catalysis, biotechnology, organic chemical technology, and polymers and other high performance materials. Basic research in chemistry and biochemistry forms an important part of the overall programme of the laboratory.

SIGNIFICANT ACHIEVEMENTS

- NCL has developed a series of zeolite catalysts (Encilites) to produce important industrial chemicals like *p*-xylene, ethylbenzene and olefins. Many non-zeolite and homogeneous catalysts have also been developed for producing various chemicals.
- Examples of the important drugs developed by the laboratory are: Ibuprofen and intermediate for Ranitidine using an innovative approach. NCL has also developed an innovative method for producing Vitamin B_6.
- Processes developed in the area of agrochemicals include those for endosulfan, dimethoate and ethion. A non-phosgene/non-MIC route has been developed for carbamate pesticides.
- The laboratory's development of Jalshakti, a water absorbing polymer, has a great relevance to waste-land development, forestry and edible oil programmes of the country.
- In the area of engineering plastics, the laboratory has developed a fibre-reinforced thermoplastic material and successfully used it for producing some critical components of the engines of two- wheelers.

Injection moulded rotor fan

Uniit for drag reducers for
oil transport

- For the pipeline transportation of crude oil and its products, NCL has developed a drag reducing polymer which reduces drag up to 80%, at concentrations as low as 5 to 20 ppm.
- NCL has an impressive record of achievements in the area of plant tissue culture. Successes in the field relate to micropropagation of elite forest trees like teak and eucalyptus, disease-free, high-yielding variety of cardamom, and *in vitro* coaxing of flowering in bamboo.
- An innovative process developed by the laboratory, with a far reaching relevance in the energy sector, is the Encilium process for the fermentation of molasses to ethanol, using a special yeast strain. Ethanol, in view of the scarcity of petrol, is being looked upon as a potential alternative fuel for vehicles.
- An IR spectrophotometer (IRS 4000) has been developed under the DST instrument development programme.

IRS 4000 IR spectrophotometer

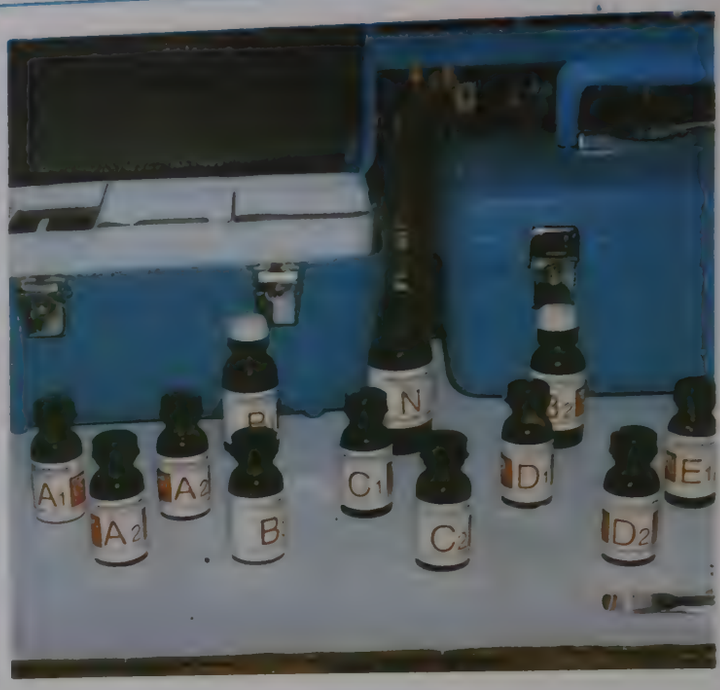
Encilium plant at
Dhampur Sugar Mills Ltd, Dhampur

Ethylbenzene plant at Hindustan Polymers Ltd, Visakhapatnam

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

NCL has successfully transferred a number of technologies to industry. Some of the major technologies transferred recently are:

- Catalytic reforming, xylene isomerization (IPCL, Vadodara)
- Ethylbenzene, *p*-diethylbenzene (Hindustan Polymers, Visakhapatnam)
- Prostaglandins (Astra-IDL, Bangalore)
- Polymer alloys/blends and components (Bajaj Auto Ltd, Pune)
- Encilium (Dhampur Sugar Mills Ltd, Dhampur)
- Catalyst for formaldehyde (Cibatul, Atul)
- Catalysts for ethylbenzene, styrene, etc. (UCIL, Vadodara)
- Piperazine & ethylene diamine (Diamines and Chemicals Ltd, Vadodara)
- Drug detection kit for narcotics; polymeric support for immobilized enzymes (Hindustan Antibiotics Ltd, Pune)
- Cardamom by plant tissue culture (A.V. Thomas & Co., Cochin)
- Eucalyptus by plant tissue culture (Tata Tea Ltd, Munnar)
- Vitamin B_6 (Lupin Laboratories Ltd, Bombay)
- Theophylline, aminophylline and caffeine (Pefco, Thane)



Detection kit for narcotic drugs

- Sodium/potassium ferrocyanides (Hindustan Development Corporation Ltd, New Delhi)
- Polymer blends (B.M. Thakkar & Co., Vapi)

TECHNOLOGIES READY FOR TRANSFER

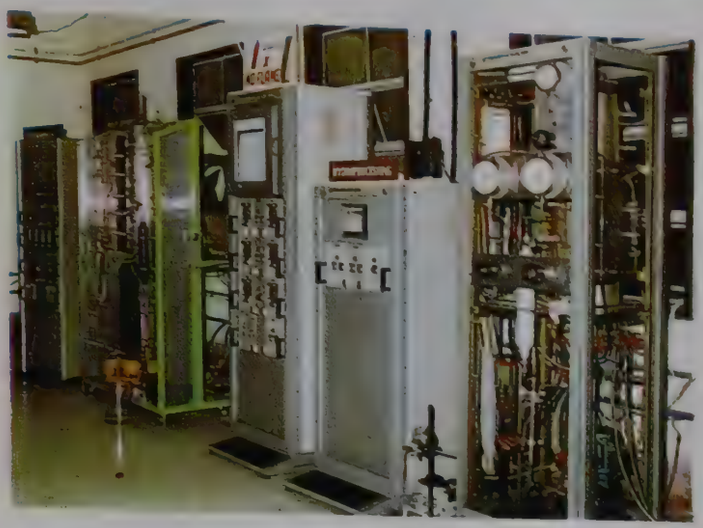
- Encillium process for making ethanol
- Process for making vitamin B_6
- Plant tissue techniques for cardamom, eucalyptus, pomegranate and sugarcane

MAJOR FUTURE PROGRAMMES

The future programmes of NCL will be directed towards the development of high performance chemicals and materials using computer-aided synthesis and knowledge-based expert systems. NCL has realized that the multidisciplinary background in its consultancy practice must bring "added value" to its clients as they develop business strategies for the 21st century. NCL has therefore decided to help clients in all aspects of business.

MAIN FACILITIES

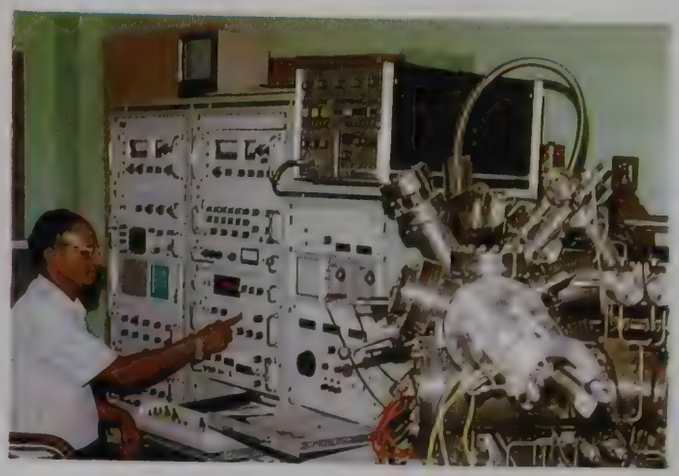
- A wide range of modern instruments for characterization and structure determination of chemicals
- A sophisticated catalyst testing unit
- Facilities for fabrication of polymer engineering components
- Gene synthesis facilities
- Pilot plant facilities
- Workshop facilities



Catatest unit

Twin-screw extruder in polymer engineering laboratory

Gene-synthesizer in bio-organic laboratory



Electron spectroscopy for chemical analysis

- Computer facilities
- Library, housing the National Information Centre for Chemistry and Chemical Technology (NICHEM)

SERVICES OFFERED

NCL offers consultancy services to industry, R&D units, project engineering organizations within and outside India and undertakes contract research on specific problems and requirements of industry. The laboratory's clientele abroad include: Du Pont, Eastman Kodak, Rohm and Haas, and Toray. Recently, the laboratory won a consultancy bid, against stiff global competition, for providing technical expertise for World Bank-assisted projects in China.

The laboratory also provides analytical and testing services to the industry and educational and research institutions.

NICHEM, located in the NCL library, has access to international databases. The facility is extensively used by industry and educational institutions. The new information-based products and services that NCL offers are: Technology monitoring, assessment and forecasting, multi-client studies on emerging technologies and new products, services for corporate planning and diversification, market potential studies, simulation, process control and engineering software services, and technical information retrieval, collection, documentation and management

TRAINING COURSES

The laboratory conducts training courses for industry, R&D organizations and educational institutions, in its areas of activity.

PUBLICATIONS

The laboratory publishes *NCL Bulletin* (quarterly) and its annual reports.

Contact Person: Director, NCL

National Environmental Engineering Research Institute (NEERI)

Nagpur 440 020
Telephone: 526071-75 (PBX) Telegram: NEERI NAGPUR
Telex: 0715-233 NEERI IN FAX: 0712-523893
E.Mail: root % neeri @ sirnetd. ernet. in

Established: 1958
Director: Dr P. Khanna, Ph.D. (Engg.)
Budget for 1992-93: Rs 361 lakh (CSIR)+ Rs 620 lakh (EBR estimated)

MANDATE

- To conduct research in different areas of environmental engineering
- To carry out R&D work in the areas of environmental monitoring, environmental biotechnology, hazardous wastes management, and environmental systems design, modelling and optimization
- To conduct environmental impact and risk assessment for industrial units
- To help in social upliftment through mission programmes on Drinking Water and Ganga Action Plan, etc.
- To carry out environmental policy analysis

MAJOR R&D PROGRAMMES

The major R&D programmes of the institute relate to national/ societal missions on drinking water, Ganga Action Plan, etc., environmental monitoring, environmental biotechnology, hazardous waste management, environmental impact and risk assessment, environmental systems design, modelling and optimization.

SIGNIFICANT ACHIEVEMENTS

- Formulation of an integrated approach to water resources management with environmental carrying capacity as the basis in districts of Barmer, Koraput, East Sikkim and Nagpur
- Design, demonstration and installation of iron removal plants and defluoridation plants at various places in the country

Defluoridation plant at Samadhilaya, District Bhavnagar, Gujarat

- Impact assessment of Ganga Action Plan on public health at Varanasi & Nabadwip; evaluation of 2 sewage treatment plants in Patna for the Ganga Project Directorate
- Designing and implementation of waste recycling system at Swargashram in Rishikesh employing the Rotating Biological Rope Contractor, a technology developed by the institute
- Development and application of water supply and sanitation programmes for villages
- Development of indigenous low-cost air pollution control technology for small-scale industrial sectors
- Study of air quality trends in 10 major Indian cities for 12 years

Microprocessor controlled sequential air sampler

- Development of nucleic acid probes for detection of enteric viruses and *Entamoeba histolytica* in drinking water
- Design of two full scale plants for biomethanation and six for reuse of industrial wastes
- Biotechnological production of 2,3-butanediol from water hyacinth; biotechnological conversion of methane to methanol
- Photoproduction of hydrogen from industrial waste waters
- Microbial desulphurization of crude oil and natural gas
- Microbial degradation of oil spills
- Use of r-DNA technology for industrial wastewater treatment
- Development of molten salt combustion technology and biodegradation of xenobiotics
- Indigenous catalytic converter technology for autoexhaust emission control
- Engineering packages for common effluent treatment plants; modular packages for wastewater treatment
- Development of software for environment systems modelling with recourse to Group Method of Data Handling; health-environment interface modelling; minimal cost designs of water supply systems; development of software for computer-aided EIA of industrial projects and risk assessment with recourse to Monte Carlo Simulation and Fuzzy Fault Tree Analysis
- Development of environment management plan for Bombay sewerage project, and regional EIA and carrying capacity studies at Jamshedpur
- Environmental impact assessment of water resources, mining, ports/harbour and industrial projects

Fixed film biomethanation pilot plant for treating 50 m^3/day hospital wastewater at Government Medical College, Nagpur

Catalytic converter for autoexhaust emission control

- Development of a database on cleaner technologies of industrial production

TECHNOLOGIES TRANSFERRED

- Knowhow on two-stage size fractionator (dust sampler) (Envirotech Instruments Pvt. Ltd, New Delhi)
- Knowhow on physico-chemical and rapid bacteriological analysis kits (L.Tek, Nagpur)
- Technology for auto-exhaust smokemeter (Envirotech Instruments Pvt. Ltd, New Delhi)

TECHNOLOGIES READY FOR TRANSFER

- Wind direction & wind velocity recorder
- Diaphragm pump & soil free vacuum pump for air sampling
- Electrically controlled automatic sequential air sampler
- Multigas sampling kit
- Field kit for iron estimation
- Titrimetric water analyzer
- Rapid aqua tester
- Chloroscope for estimation of residual chlorine
- Automatic burette and pipette
- Improved electrolytic respirometer
- Devices for defluoridation of water by Nalgonda technique (hand pump attachable, and fill & draw and continuous flow types)
- Chlorine tablets and ampoules
- Low-cost sanitation systems for rural areas
- Low-cost air pollution control technologies for small scale industrial sectors
- Fixed-film reactor technology for biomethanation of wastewater
- Technology for recovery of biogas from landfills
- Molten salt combustion technology for destruction of hazardous industrial wastes
- Indigenous catalytic converter for autoexhaust emission control
- Low-cost water treatment systems for small communities

Water treatment plant

- Common effluent treatment plants
- Resources recovery-based low-cost wastewater treatment systems
- Basic engineering packages for wastewater management in industries
- Cellulosic membranes for reverse osmosis systems; noncellulosic membranes for ultrafiltration systems
- Reclamation and development of mine spoil dumps.

One year old teak plantation at Dongribuzrug Mines of MOIL, for reclamation and development of manganese mine spoil dumps using domestic and industrial wastes

MAJOR FUTURE PROGRAMMES

The institute will strengthen and diversify its R&D programmes on:

- Environmental systems design, modelling and optimization for the protection of air, water, land, biological and socio-economic components of environment
- Environmental impact and risk assessment of major developmental projects
- Application of r-DNA technology for environmental preservation
- Cleaner technologies for industrial production
- Hazardous and toxic waste management
- Environmental policy analysis

MAIN FACILITIES

- Sophisticated instrumentation for analysis of pollutants
- Excellent computer facilities for large memory oriented software and databases. NEERI is procuring three advanced work stations with necessary software for activities related to Geographic Information System (GIS), Digital Image Processing (DIP) and Knowledge Based System (KBS).

SERVICES OFFERED

- Consultancy services to industry and other agencies on pollution control measures, water purification techniques, waste water/effluent treatment processes and environmental impact analysis (EIA) studies
- Collection and maintenance of National Air Quality Data

Marine Water Sampling in EIA study of Madras Port Trust, Madras

TRAINING COURSES

The institute conducts training courses for industry and governmental/non-governmental organizations in the areas of air pollution monitoring and control, analytical quality control, environmental biotechnology, solid wastes management, and environmental impact assessment

PUBLICATIONS

The institute brings out *Indian Journal of Environmental Health, Paryavaran Patrika* (Hindi) and its annual reports

Contact Person: Director, NEERI

ZONAL LABORATORIES:

NEERI Zonal Laboratory
Sewage Farm Road
Ahmedabad 380 022
Telephone: 391300

NEERI Zonal Laboratory
89/B, Dr A.Hasant Road
Worli
Bombay 400 018
Telephone: 4936635, 4929607
Telex: 011-75462

NEERI Zonal Laboratory
Sector IV & V, Block AQ
Plot 2, Salt Lake City
Calcutta-700 091
Telephone: 342667

NEERI Zonal Laboratory
Lala Shamnath Marg
Delhi 110 054
Telephone : 2522866, 2514131

NEERI Zonal Laboratory
IICT Campus
Hyderabad 500 007
Telephone: 853539
Telex: 0425-7061 IICT IN

NEERI Zonal Laboratory
A-11, Mahavir Udyanpath
Bajaj Nagar
Jaipur 302 017
Telephone: 510872

NEERI Zonal Laboratory
6/33, Civil Lines
Kanpur 208 002
Telephone: 240127

NEERI Zonal Laboratory
'Nisha', 35/1100
Chakkungal Road
Kochi 682 025
Telephone: 344788

NEERI Zonal Laboratory
CSIR Complex, T.T.T.I.
Taramani P.O.
Madras 600 113
Telephone: 2351964
Telex: 041-21067 CSIR IN

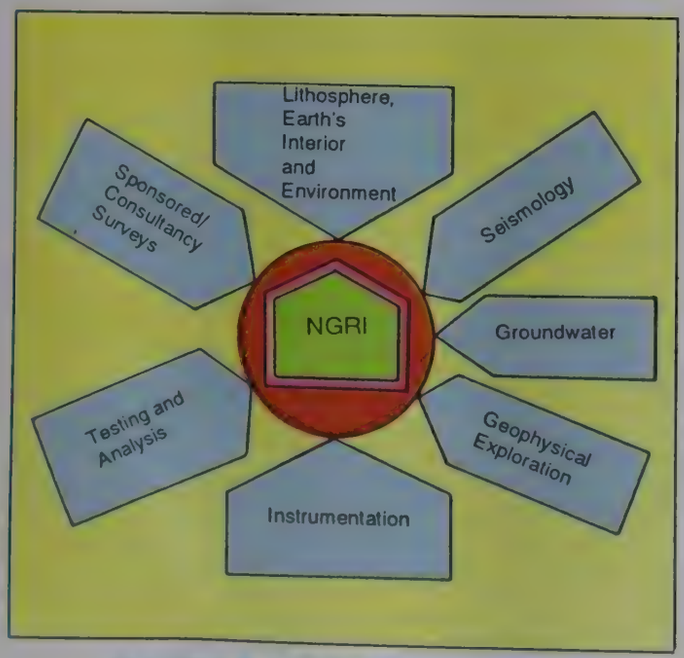
National Geophysical Research Institute (NGRI)

Uppal Road, Hyderabad 500 007
Telephone: 850 141
Telegram: GEOPHYSICS HYDERABAD
Telex: 0425-7018 NGRI IN FAX: 854164

Established: 1961
Director: Dr Harsh K. Gupta, M.Sc., Ph.D.
Budget for 1992-93: Rs 756 lakh (RE)

MANDATE

- To carry out basic and applied research in the frontier areas of solid earth geophysics
- To obtain information about earth's interior by the study of electrical, magnetic, thermal and gravitational fields
- To study the history of the lithosphere and crustal evolution in space and time, and to carry out integrated geological, geochemical, geophysical and geochronological studies
- To device new methods, techniques and instruments for the exploration of minerals and ground water resources by geophysical methods
- To study the processes involved in earthquakes and related phenomena
- To participate in national and international geoscientific programmes



MAJOR R & D PROGRAMMES

The major R & D activities of the institute are grouped under five broad areas: (i) seismology, (ii) lithosphere, earth's interior and environment, (iii) groundwater, (iv) geophysical exploration and (v) geophysical instrumentation.

SIGNIFICANT ACHIEVEMENTS

- Development of ground, shipborne and airborne geophysical instruments

Soil-gas sampling for helium survey in Rajasthan

- Physical and numerical modelling for interpretation of geophysical data
- Development of facilities for airborne geophysical survey
- Deep seismic sounding (DSS) studies to help oil exploration programmes
- Studies on the dynamics of the solid earth
- Aeromagnetic surveys in Antarctica
- Extensive surveys for groundwater and civil engineering investigations

- Monitoring of reservoir induced seismicity
- *In situ* stress measurements for studying mine safety

MAJOR SPONSORED SURVEYS CARRIED OUT/TECHNOLOGIES TRANSFERRED

- Completed 2.50 lakh line km of airborne geophysical surveys
- Covered 23 profiles (more than 5000 line km) by DSS studies
- Carried out survey in more than 1500 villages for groundwater under the Technology Mission on Drinking Water
- Carried out magnetotelluric survey in Saurashtra basin for oil exploration
- Carried out bed rock and archaeological investigations
- Reservoir-induced seismicity (RIS) investigations at dam sites
- Transfer of knowhow for the commercial production of several geophysical instruments

TECHNOLOGIES READY FOR TRANSFER

- Dual frequency electromagnetic unit
- Data storing magnetometer

MAJOR FUTURE PROGRAMMES

- Earthquake prediction & hazard evaluation
- Exploration for oil & gas
- Development of geophysical instruments
- Investigation of Earth's crust & interior

MAIN FACILITIES

- Laboratory facilities for geochemical, geological and geochronological studies: X-ray fluorescence spectrometer, atomic absorption spectrometer, electron probe microanalyzer, plasma source mass spectrometer, UV-vis spectrophotometer, thermal ionization mass spectrometer, γ-ray spectrometer, helium sniffer, etc.
- Stable isotopes, radiocarbon & tritium, tracer, paleomagnetic and high temperature & pressure laboratories
- Mainframe computer system (Cyber 180/850A) and Vax 11/750 facility
- Observatories for seismological, magnetic and electrical properties of the earth
- Mobile observatories at dam sites

SERVICES OFFERED

NGRI undertakes surveys for oil, minerals and groundwater, and studies relating to bed-rock investigations, geohydrological & groundwater management, RIS and *in situ* stress measurements, on sponsored basis.

The institute also provides analytical and testing services to universities and industries.

Micro-Raman spectrometer at Mineral Physics Laboratory

TRAINING PROGRAMMES

The institute regularly conducts training courses for students and in-service personnel in geophysical exploration methods and other related areas.

PUBLICATIONS

The institute publishes its annual reports.

Contact Person: Director, NGRI

FIELD STATIONS (OBSERVATORIES)

Equatorial Magnetic and Micropulsation Observatory, Ettaiyapuram, Tamilnadu

Network Seismic stations in the North-East region of India

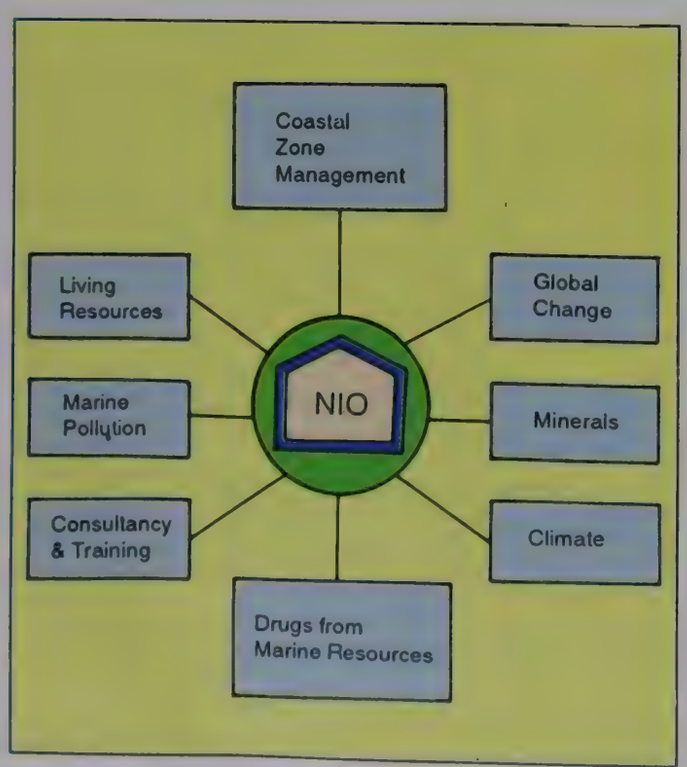
National Institute of Oceanography (NIO)

Dona Paula, Goa 403 004
Telephone: 46253 to 56 & 53352 Telegram: OCEANOLOGY, PANAJI
Telex: 0194-216 NIO IN & 0194-316 MGG IN FAX: 91-(0)832-53361, 53360

Established: 1966
Director: Dr B.N. Desai, M.Sc., Ph.D. (Wales)
Budget for 1992-93: Rs 819 lakh

MANDATE

- To develop a knowledge-base relating to physical, chemical, biological, geological, geophysical, engineering and pollution aspects of the seas around India
- To build up competence for exploiting the sea resources for the benefit of the country
- To develop self-sufficiency in marine instrumentation
- To extend co-operation to all R&D organizations and academic institutions involved in the study of marine sciences, and cater to information needs of the user community
- To foster national and international co-operation in various fields of oceanography to facilitate the exploration and exploitation of the sea
- To provide support to various industries, government and non-government organizations through consultancy, contract research, training, etc.



MAJOR R&D PROGRAMMES

The major R&D programmes of NIO include: International Geosphere- Biosphere Programme, surveys for polymetallic nodules, oceanographic studies of the Antarctic waters, island development programme, coastal zone management, resources and parameters mapping of the EEZ of India, air-sea interaction studies, drugs from the sea, marine biotechnology, biofouling and corrosion studies, technologies for rural development, development of marine instruments, and development of acoustic and remote sensing techniques for monitoring the oceans.

SIGNIFICANT ACHIEVEMENTS

- NIO has carried out physical, chemical, biological, geological and geophysical studies of the Exclusive Economic Zone (EEZ) of India and other areas in the Indian Ocean which have led to understanding of the ocean processes and the resources hitherto unknown

Floating cage for culture of marine fin fishes

- The institute has carried out surveys of marine living resources and developed new culture techniques with a view to increasing the seafood production. A technique for culture of green mussels on ropes from floating rafts has been successfully developed and the

knowhow has been transferred to fish farmers of Goa. A technique for the culture of *Artemia* has been perfected and commercialized. Culture technique for commercially important marine organisms like fin fish in floating cages has been developed.

- A survey by the institute of the shallow offshore areas of Konkan coast has indicated ilmenite deposits of about 12.5 million tonnes. Also, bathymetric, sedimentological, geochemical, geomorphological and magnetic anomaly maps for major portion of the Indian continental shelf have been prepared

3-D picture of the sea floor in an area of the Central Indian Ocean

- The institute has carried out survey for polymetallic nodules in an area of about 4 million sq.km in the Central Indian Ocean. This work has resulted in registration of India as the first 'Pioneer Investor' country in the world under UN and getting allocation of an area of 1,50,000 sq.km for developing a mining site
- Sedimentation in harbours and adjacent areas has been studied to find ways to tackle the problem of siltation. Dynamics of the seasonally reversing coastal circulation has been studied in detail
- Equipment for scanning the ocean interior and numerical acoustic models have been developed and sound-speed structure reconstructed. The acoustic field from Antarctic to the Central Arabian Sea at 74°E has been prepared. A methodology for operation of an ocean acoustic tomographic system has also been developed
- A few models covering land-sea and air-sea interactions and ocean dynamics have been developed to understand variability of monsoon. Studies on the anticipated sea level rise due to Greenhouse Effect have revealed that Lakshadweep Archipelago is most vulnerable to inundation
- More than 400 species of marine flora and fauna have been studied for antiviral, antifungal and CNS depressant activities. A new toxic sapogenin has been isolated from sea cucumber
- NIO has developed a method for the preparation of lysate amoebocyte limulus (LAL), a testing agent for microbial endotoxins, from the blood of horse-shoe crab without sacrificing the animal. LAL is used in drugs, pharmaceutical and food industry.
- A chemical model of the Arabian Sea has been developed using thermodynamic data of the major and minor components of sea water. Regular monitoring of the Indian sea with regard to pollution by heavy

Indian horseshoe crab sp. *Tachypleus gigas* (Huller) collection site, Balramgari, Orissa

Automatic Weather Station

metals, pesticides, hydrocarbons, etc., has helped to assess the health of our seas

- NIO was the lead organization in organizing the First Indian Scientific Expedition to Antarctica and has participated actively in the subsequent expeditions
- An Ocean Remote Sensing Centre has been set up at NIO to develop remote sensing techniques for ocean studies. Various ocean features have been studied and mapping of mangrove vegetation and geomorphological studies using remote sensing technique have been carried out. NIO has also released the technical knowhow for several marine instruments like electronic bathythermograph, wind recorder, automatic weather station and direct reading current meter to NRDC. A self-recording and transmitting tide gauge has also been developed and commercialized.

MAJOR TECHNOLOGIES TRANSFERRED

- Technique for culture of green mussels on ropes using wooden rafts
- Technique for commercial culture of *Artemia*, a live feed for shrimps
- Technique for culture of fin fishes in floating cages
- Use of horse-shoe crab blood without sacrificing the animal, for preparation of LAL, by transfusion of amoebocyte on recurring basis
- Microbial culture for biopulping, biobleaching & effluent treatment in paper industry
- Pollution monitoring using bioluminiscent bacteria
- Electronic tide gauge, electronic bathythermograph, wind recorder, automatic weather station and direct reading current meter.

Electronic tide gauge

MAJOR FUTURE PROGRAMMES

The major future programmes of NIO relate to exploration for living and non-living resources, global change, ocean modelling and development of prediction systems of marine environment.

MAIN FACILITIES

- Research vessels *'Gaveshani'* and *'Sagar Kanya'* (of DOD) which are well equipped for oceanographic research throughout the year.

R.V. Gaveshani

Image processing system for remote sensing studies

- Well-equipped modern laboratories which can cater to the needs of all branches of oceanography
- Indian National Oceanographic Data Centre (INODC) for acquiring, processing, and disseminating oceanographic data pertaining to the Indian seas, and a library which serves as the National Centre for Aquatic Sciences and Fisheries Information System (ASFIS).
- Norsk Data Computer ND-520 and ND-570 and DTP; image processing system for remote sensing studies; workshop, printing, photography and drawing units.

SERVICES OFFERED

- The institute undertakes sponsored projects and offers consultancy on: coastal zone development, submarine pipeline, seabed surveys and marine outfalls, environmental impact assessment and ocean engineering, pollution control and waste disposal in the sea, port and harbour development, design and development of marine instruments, resource surveys, marine biotechnology, marine archaeology, and any other problems connected with the sea.
- NIO provides training in exploring the sea resources, shipboard training in the collection and processing of oceanographic data, and facilities and divers for underwater exploration.
- NIO provides library services including ASFA CD-ROM literature search, services for dissemination of oceanographic data, ofline multiuser search facility on UNIX platform for information on marine biotechnology and marine science and technology information services.

TRAINING COURSES

NIO undertakes short-term training courses for government agencies, R&D organizations and educational institutions both in India and abroad, in the field of marine science.

PUBLICATIONS

NIO publishes a quarterly bulletin, annual reports, technical reports, cruise reports, information brochures, etc. Other priced publications available are: *Wave Atlas for the Arabian Sea and Bay of Bengal*, *Oceanographic Atlas of the Exclusive Economic Zone (EEZ) of India*, and data inventories.

Contact Person: Director, NIO

REGIONAL CENTRES

NIO Regional Centre Pullepady Cross Road,
Post Bag No 1913
Cochin 682 018
Telegram: OCEANOLOGY, COCHIN
Telephones: 360306 & 369384

NIO Regional Centre
Sea Shell Building
Seven Bungalows
Versova
Bombay 400 061
Telegram: OCEANOLOGY, BOMBAY
Telephones: 574807 & 573662
Telex: 011-71182 NIO B

NIO Regional Centre
8-1-70, Bonanza
Peda Waltair
Visakhapatnam 530 017
Telegram: OSTECHLAB, WALTAIR
Telephones: 64634 & 63992

National Institute of Science, Technology and Development Studies (NISTADS)

Dr K.S. Krishnan Marg, New Delhi 110 012
Telephone : 5743227, 5714064 Telegram : NISTADS NEW DELHI
Telex : 031-77182 NSTD IN FAX: 091-011-5754640
E. Mail : nistads@sirnetd. ernet. in

Established : 1981
Director: Dr Ashok Jain, M.Sc., Ph.D.
Budget for 1992-93 : Rs 160 lakh

MANDATE

- To carry out research in the area of Science and Technology Studies (STS), specially the interactive processes of the science-technology-society-development nexus
- To provide consultancy services and undertake sponsored research & commissioned studies in the above areas for international and national agencies, central and local government bodies, industries and other organizations concerned with policy formulation, planning and management of science and technology.
- To build, maintain and provide services based on information data banks in science policy areas and archives of S&T; and to conduct training courses in the areas of expertise of the institute

History & Philosophy of Science
R & D Management and Technology Forecasting
Consultancy & Training
Sociology of Science
NISTADS
Mathematical Modelling for S & T Studies
Information System & Databases
Application of S & T in Rural Areas
S & T Indicators and Scientometrics

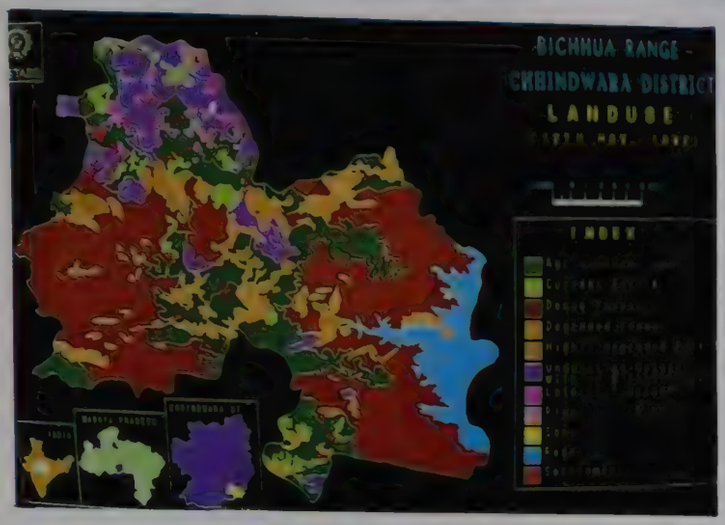
MAJOR R&D PROGRAMMES

The major R&D programmes of NISTADS relate to mathematical modelling for S&T studies; S&T indicators and scientometrics; sociology of science; resource planning & utilization for regional development; information systems & S&T archival resources; technological and social change; history & philosophy of science; R&D management and training; and international polity and S&T.

SIGNIFICANT ACHIEVEMENTS

The institute has carried out significant work relating to technology assessment and transfer; technology forecasting; opinion surveys on problems of S&T management; resource planning and utilization for regional development; S&T indicators; international polity and S&T; history and philosophy of science; application of S&T in rural areas; and information systems and database. The projects completed by the institute relate to:

- R&D/industry profiles for aluminium, sugar, cement, drugs, pesticides, polymers, soaps, etc.
- Studies/reports on strategies for development of tungsten industry in India; saving of energy by substitution of steel with aluminium in vehicles; environmental regulations on hazardous chemicals and microorganisms in India; linkages of R&D institutes with industry and academic institutions; technology utilization systems of the major scientific agencies in India; technology assessment and transfer mechanisms of Indian biotechnologies programmes in health and agriculture sector, and industrial strategies for development of machine translation systems
- Delphi study on the use of ELISA techniques in diagnostics in India; mathematical modelling for forecasting colour TV market in India and substitution and diffusion of innovations; and modelling and analysis of manpower planning in CSIR labs
- Technology improvement and product diversification for village artisans making fishing hooks, pottery and leather goods (Bankura, West Bengal and Mewat, Haryana)
- Application of geological information system to desert/wasteland development and rural land management in Haryana; computerized natural



Land use map prepared using Indian Remote Sensing Satellite (IRS) LISS II Scene (FCC) and Survey of Indian Toposheets. Digitized for GIS applications

Wastelands types identified from IRS LISS II Scene (FCC), and finalized with the help of ground truth and secondary information. Digitized and analyzed in GIS environment using ARC INFO package

resource data management system for Gurgaon and Alwar, and Andaman & Nicobar Islands; thematic maps and development indicators for Mewat in Haryana

- Software development relating to Devanagari version of CDS/ISIS, vocabulary standardization using SPINES thesaurus, conversion of *Science Citation Index* database to CDS/ISIS database; and development of databases on science policy studies

- Studies on the role of women in science and technology, specially women's participation in R&D and academic organizations, and women technicians in India, and women in S&T in Asian region (WISTAR network project).

- Production of films on various scientific topics/issues and eminent personalities

- Status report on Indian S&T indicators and scientometric studies on Indian scientific contribution in various areas

- Studies on status of S&T in China and Afghanistan, technological trade and collaboration between India and African countries; and case studies on comparison of technology acquisition and absorption in India and China

- Studies on science and technology in ancient India; foundations of mathematics in India, China and Greece; Indian tradition in logic, mathematics and linguistics; and history of science in colonial period and in post-independent India

MAIN FACILITIES

- Modern computer facilities

- Specialized library having scientific and technology archival records and literature on science policy/science management

SERVICES OFFERED

- NISTADS undertakes science and technology policy analysis in the following areas: planning, organization and management of science; social relations of science; GIS applications for sectoral/regional planning; technology assessment and forecasting, technology development, acquisition and transfer, including comparisons between countries/regions; bibliometric studies on frontier areas of research; women in S&T.

- The institute has expertise to design and develop databases relating to S&T indicators; R&D management; R&D project management; management of natural resources for regional planning; bibliographic and non-bibliographic databases.

- Survey studies can be undertaken on various S&T related issues like impact assessment; techno-economic surveys for rural development.

TRAINING COURSES

Training is offered to scientists and officials from S&T agencies, R&D organizations and local government bodies from India and other developing countries in the following areas: R&D management (various aspects); science policy studies; scientiometrics, S&T indicators; S&T related decentralized planning for regional development.

PUBLICATIONS

NISTADS publishes *Current Literature on Science of Science*, specialized reports/books in its area of expertise, and annual reports.

Contact Person : Director, NISTADS

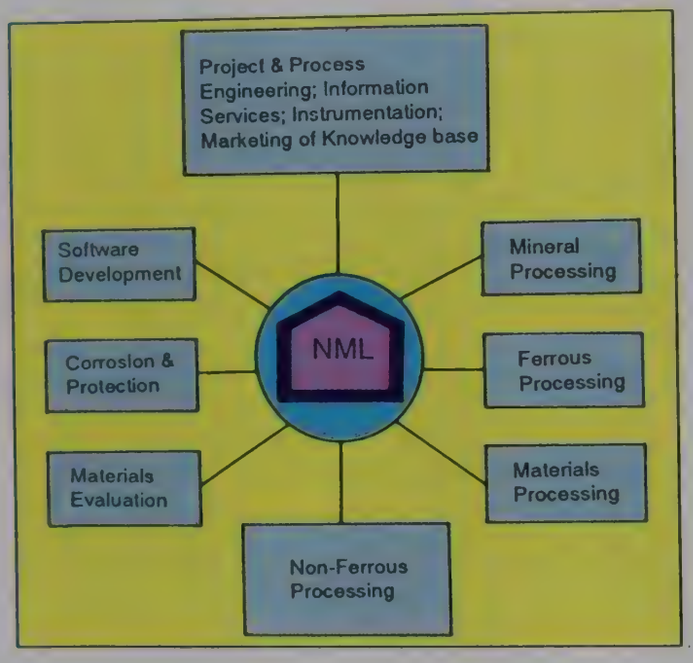
National Metallurgical Laboratory (NML)

Jamshedpur 831 007
Telephone : 26091-7 Telegram : METALS TATANAGAR
Telex : 0626-210 & 274 NMLJ IN FAX : 0657-26527

Established : 1950
Director : Prof. P. Ramachandra Rao, M.Sc. (Physics), B.E.(Metallurgy), M.Sc. (Met. Engg.), Ph.D (Met. Engg.)
Budget for 1992-93 : Rs 815 lakh

MANDATE

- To pursue excellence in research on the preparation and properties of engineering materials
- To develop knowhow for gainful utilization of mineral resources of the country
- To develop linkages with the user organizations and help them in utilizing the expertise generated



MAJOR R & D PROGRAMMES

The major R & D programmes of NML relate to ore dressing, mineral beneficiation, material processing and evaluation of ferrous and non-ferrous metals; development, processing and evaluation of alloys; and component integrity evaluation. Some of the actively pursued programmes include (i) development of process technology for recovery of nickel, cobalt and copper from polymetallic sea nodules through reduction roast, ammonia leaching, solvent extraction and electrowinning, (ii) beneficiation and purification of indigenous tungsten ores and (iii) development of reliable methodologies for life prediction and life extension of critical components in power, oil, and steel sectors.

SIGNIFICANT ACHIEVEMENTS

- NML has carried out characterization, processing and/or agglomeration studies on iron ores and other raw materials for practically all the steel plants of the country, the recent ones being those for Paradip Steel Plant, Orissa; Rashtriya Ispat Nigam, Visakhapatnam; and Durgapur Steel Plant.
- Froth flotation plants have been set up based on the NML's knowhow for recovery of fine coal values at the washeries of TISCO (Jamadoba, West Bokaro), CCL (Gidi) and BCCL (Dugda).
- Copper plants based on flow sheets developed at NML have been set up at Rakha and Malanjkhand. GMDC (Kadipani, Gujarat) and MPMMC (Chandidongri, MP) are utilizing NML's flow sheet to produce acid grade fluorspar from low grade ore.
- India's first commercial plant for producing magnesium has been put up by Southern Magnesium and Chemicals Ltd, Rajamundry (AP), based on the NML's technology.
- The national creep testing facility at NML has generated a comprehensive database on the high temperature (creep) behaviour of all indigenous steels

Creep testing facilities

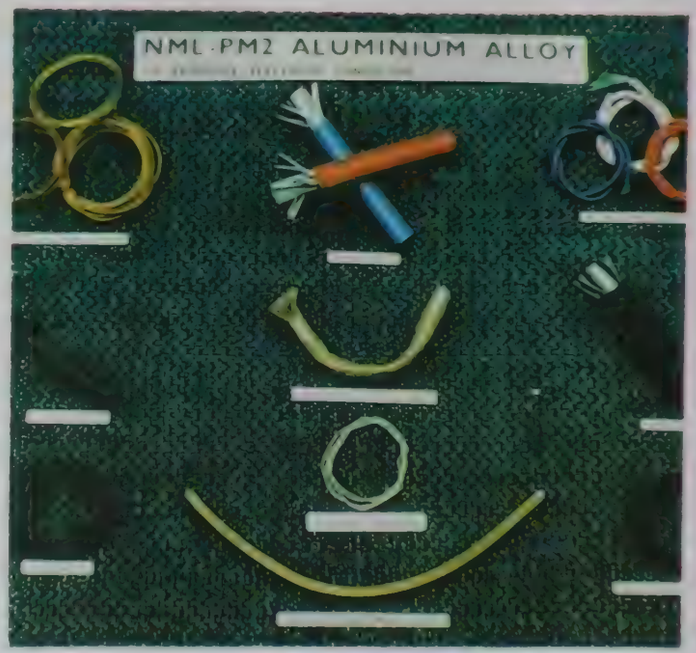
Multipurpose inhibitor — Metasave — being used at the picking line of TISCO

useful to power plants and methodologies for estimating remaining life for power plant components.

- NML has developed new grades of manganese-containing steels for high temperature use.
- NML's technology for the production of low-carbon ferro alloys is being utilized by a number of units producing Fe-Mo, Fe-W, Fe-V, Fe-Mn and Fe-Cr alloys.
- NML's technology has been used for production of battery grade manganese dioxide from Indian ores by MOIL, Nagpur. Also, a 50 kg/day pilot plant has been set up in Rangoon, Myanmar, based on the technology.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Metasave — A multipurpose inhibitor (Metoil Corporation)
- Sintered alumina (Tata Refractories Ltd)
- Vanadium pentaxoide from alumina sludge (Rare Metals, Ranchi ; SG Enterprises, Ranchi)
- Aluminium anode — Superal & Hopal (Aluminium Manufacturing Co. Ltd, Calcutta; Electro-Production Services, Madras)



Aluminium alloy conductor

- Electric grade aluminium alloy conductor NML-PM2 (Aluminium Cables, Calcutta; Galanda Continuous, Hyderabad; Universal Cables, Satna, etc.)
- Distilled zinc dust (Zinc Products & Co., Patna)
- Fluxes for submerged arc welding (Tapadia Engineers, Raipur)

Metal sheet with and without vapour-phase inhibitor

- Graphite crucible — carbon bonded (Patna State Graphite & Mining, Titlagarh)
- Equiblast-cum-balance blast cupola (blueprints have been licensed to hundreds of units)
- Heating elements [Cable Works (I), Faridabad; Heatwell (I), Calcutta]
- Mini Cupola and Equiblast Cupola designed and developed by NML are being extensively used by small-scale foundaries in the rural area.

TECHNOLOGIES READY FOR TRANSFER

Direct reduced iron by VRDR process, electrolytic manganese metal, ceramic crucible for carbon and sulphur determination in metals, alumina-based wear-resistant ceramic products, stainless steel powder; vapour phase inhibitor; zinc oxide from zinc waste, calcium silicide, steels for portable generator from micro alloyed steel sheets calorizing process, extra-fine non-ferrous metal powders, recovery of tin from secondary sources, synthetic cryolite, alkali & ethyl silicate zinc-rich primer, vinyl coated steel and aluminium, passivator for galvanized surface, ceramic magnets, refractory cement (Fondu type), aluminium conductor NML- PM 215, copper clad aluminium sheets, hot dip aluminizing, creep-resistant steels for thermal power plants, Cr, Mn, N, C, W, Mo creep-resistant stainless steels, high-speed cast steel cutting tools and lead from lead concentrate.

MAJOR FUTURE PROGRAMMES

The major future programmes of NML relate to:

- Technology for production of clean coal from coking and non-coking coals of India for conventional and specialized usage
- Advanced steel based on ultra low carbon
- Ultra high-energy hard magnets based on Fe, Nd and B
- Software packages for life prediction models for engineering components exposed to fatigue, creep-fatigue, and heat and mass transfer models for different metallurgical processes

Coal and mineral spiral pilot plant at large scale test facility of Mineral Processing Division of NML

- Silicon carbide composites (whisker and particulates), iron- aluminides for creep resistance, tabular alumina refractories, SG iron using elemental magnesium

MAIN FACILITIES

- *Pilot plants*: Mineral beneficiation facilities (0.5-5 T/hour), VRDR, 500 kVA submerged arc furnace
- *Material shaping units* : rolling mill, forging unit, wire drawing unit, extrusion press
- *Mechanical properties* : Creep testing (218 points), tensile bending (MTS, INSTRON), fatigue (Vibrophore), impact (Instrumented & conventional)
- *Analytical* : XRF, DRS, AAS, XRD instruments
- *Physicochemical characterization* : DTA/DTG, DSC, magnetic, thermal and electrical properties
- *Furnaces*: Submerged arc furnace (50 kVA), rotary kiln, other melting units (arc, induction resistance furnaces), 60 kg vacuum induction furnace
- *Microdestructive characterization* : Optical, SEM, TEM

Scanning Electron Microscope with EDAX

- *Non-destructive evaluation* : Ultrasonic, acoustic emission, eddy current
- *Mineral beneficiation* : Hydrocyclone, magnetic separator, Bartles Mozley unit, flotation cell, particle size analyzer, image analyzer, mineral microstructure characterization facilities
- *Refractories*: Characterization, mechanical behaviour
- *Instruments for characterizing corrosion behaviour* : Polarization behaviour, stress corrosion, inhibitor (liquid, vapour and gas phase).

SERVICES OFFERED

NML is a pioneer in the country in producing and supplying standard reference materials for chemical analysis. It has also supplied sample orders to Germany. Some of the important reference materials supplied by NML are: Steel, 0.57 Carbon (No. 13.4), Low Alloy Steel (No. 23.4), Ferro Chrome (No. 30.1), Iron Ore (No. 61.2).

Testing of metals and minerals (analytical, mechanical, metallurgical, magnetic, refractory) is undertaken.

PUBLICATIONS

The laboratory publishes *NML News, Technical Journal* and its annual reports.

Contact Person: Director, NML

FIELD STATIONS

NML Centre,
CSIR Madras Complex,
P.O. TTTI, Taramani,
Madras 600 113

NML Field Station,
Industrial Estate,
P.O. Batala,
Punjab 143 505

NML Field Station,
Industrial Estate,
P.O. Baltikuri,
Dist. Howrah,
West Bengal 721 428

NML Field Station,
Industrial Estate,
P.O. Narola,
Ahmedabad 382 330.

NML Marine Corrosion Research Station,
Digha, Dist. Midnapore,
West Bengal 721 428

NML Regional Liaison Centre,
4, India Exchange Place (7th Floor),
Calcutta 700 001.

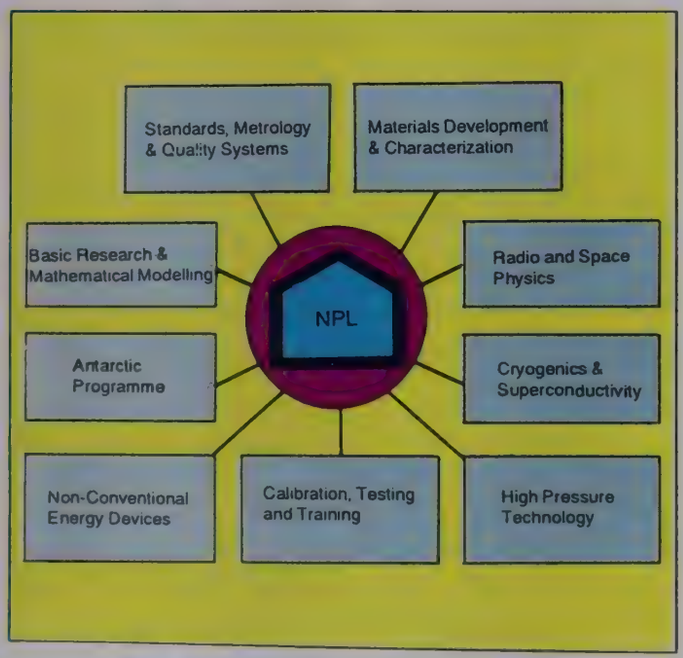
National Physical Laboratory (NPL)

Dr K.S. Krishnan Marg, New Delhi 110 012
Telephone: 5787161 Telegram: NATPHYLAB NEW DELHI
Telex: 031-77099 NPL IN 031-77384 RSD IN FAX : 91-11-5752678
E. Mail: npl@sirnet. ernet. in

Established: 1950
Director: Prof. E.S.R. Gopal, M.A., M.Sc., Ph.D., F.N.A, F.A.Sc., F. Inst P., F.N.A.Sc.
Budget for 1992-93: Rs 1081 lakh

MANDATE

- To establish, maintain and improve National Standards of measurements, and to realize the 'Units' based on International System (under the Subordinate Legislations of Weights and Measurements Act 1956, reissued in 1988 under the 1976 Act)
- To carry out R&D work with a view to advancing the frontiers of knowledge in various areas of physics and applying the knowledge for the technological advancement of the country
- To assist industries, national and other agencies by offering consultancy services for precision measurements, calibration, development of devices, processes, and solving other allied problems related to physics



MAJOR R&D PROGRAMMES

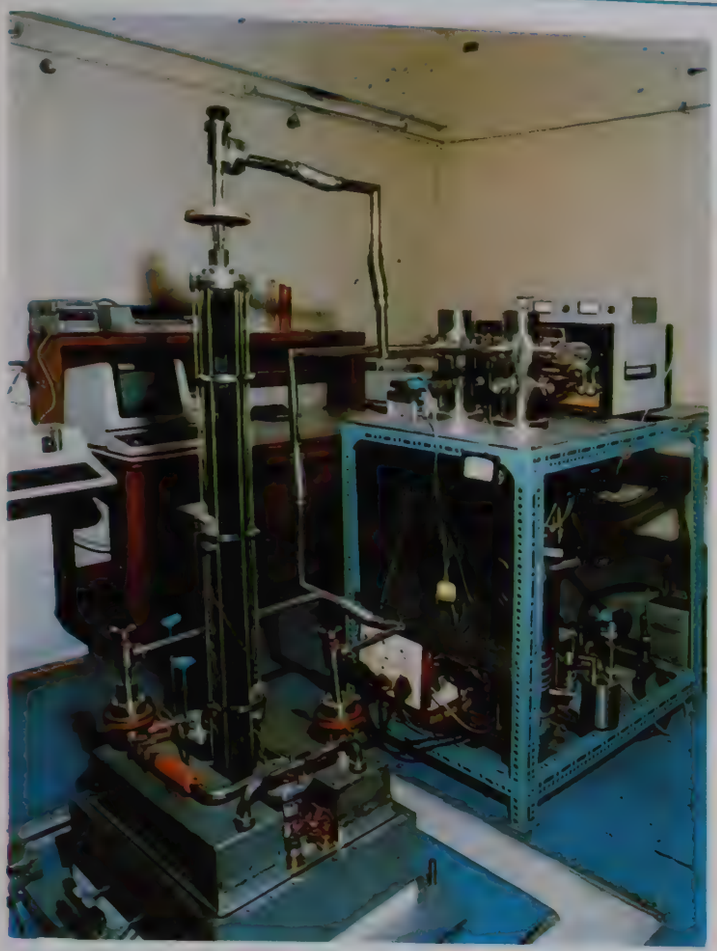
The major R&D programmes of NPL can be categorized in the following broad areas: (i) measurements, standards and calibration, (ii) electronic & engineering materials, (iii) radio and atmospheric physics, (iv) cryogenics and superconductivity, (v) applied projects like thin films, optical coatings, xero-radiography, high-pressure metal forming & high-powered ultrasonic systems, and underwater acoustic devices, (vi) non-conventional energy devices, and (vii) theoretical condensed matter physics.

Establishment, maintenance and updating of national standards of physical measurements at internationally accepted levels of accuracy, precision measurements and calibration has been an important activity of the laboratory. Under the Subordinate Legislations of Standards of Weights & Measures Acts, NPL has the responsibility of realizing the units of physical measurements under the International System, and of establishment, custody and maintenance of 'National Standards' of measurements of these units (except for ionizing radiations, which are maintained at BARC-Bombay).

SIGNIFICANT ACHIEVEMENTS

Under a scheme entitled National Coordination of Testing and Calibration Facilities (NCTCF), the

A view of the coaxial microcalorimeter assembly developed by NPL in collaboration with PTB, Germany



Manobarometer based on ultrasonic interferometric principle set up at NPL for precise measurement of pressure in the range of 1 Pa to 130 kPa

Government of India has given the responsibility of coordination of the calibration activity in the country to NPL. The National Standards of Measurements aremaintained at NPL through the three Echeleon System of Calibration Laboratories. National measurements have been established at NPL for more than 100 parameters (base & derived).

- Technologies for the following strategically vital materials have been successfully developed and transferred for commercialization in the recent past: (i) carbon - carbon composites for nose tips of space vehicles, leading edges, fighter brake pads, etc; (ii) aviation grade brushes and rear view prisms for MIG fighter planes, (iii) space quality filters for aerospace applications and (iv) Panex fibre for fighter plane brake pad precursor, aircraft, seats etc.

- Technologies for the following materials of commercial importance have been developed or are at advanced stages of development: (i) flexible graphite for seats, gaskets, gland packing, refineries, petrochemicals, thermal power stations, etc.; (ii) glassy carbons for fuel cells & biochemical applications, (iii) monochrome TV phosphors; (iv) piezoelectric ceramics for low power applications, (v) thin film optical coatings and (vi) silver-impregnated graphite contacts for relays.

- NPL has developed a hybrid 10 tesla superconducting magnet for a magnetic ore separator for BHEL, Hyderabad.

Flexible graphite sheet and its artifacts

A hybrid superconducting magnet — Left : 86 mm bore, 7.8T Nb-Ti coil; Right : 45 mm bore, 3.2 T Nb-Sn insert coil

- NPL has been a major participant in all the scientific expeditions to the Antarctica held so far and has been coordinating activities in respect of instrumentation, planetary boundary layer and ozone monitoring studies.

- Atmospheric scanning, especially of Green House gases and their impact on ecological balance is being carried out under the Global Change Programme.

- Pioneering work has been done by NPL in the field of noise pollution covering city noise, traffic noise, indoor & outdoor, and diurnal variation of noise.

- Six reference materials of lead, cadmium, arsenic and chromium, of significant importance to environmental pollution control and monitoring, have been prepared and are being supplied by NPL.

- NPL is actively involved in R&D pertaining to conventional as well as high T_c superconductors. Some of the important studies undertaken in the recent past in-

A 160 mm bore 5T superconducting magnet developed by NPL in collaboration with BHEL (R&D), Hyderabad, being lowered into a liquid helium dewar for testing, before being assembled in the magnetic ore separator system

Sensor packages RPA-11 (left), RPA-12 (centre) and RPA-13 (right) developed by NPL

clude: (i) STM studies of growth spirals in bulk single crystal and the problem of critical density; (ii) inter-layer coupling effects and optimization of T_c of Bi-2212 high T_c cuprates; (iii) substitution studies in Y-124 cuprates; (iv) studies on Y-123 systems; and (v) high T_c Josephson junction and SQUIDs.

- Acoustic radars have been set up to monitor the boundary layer to aid radar and microwave propagation studies. Balloon and rocket payloads have been designed and launched to study the atmospheric minor constituents. A sophisticated Retarding Potential Analyzer (RPA) payload has been designed and fabricated to study the energetics of low latitude ionosphere and thermosphere; it was launched on the Indian SROSS-C satellite in May 1992. Research on planetary atmospheres has fructified in the discovery of equatorial anomaly in Jovian and Saturn ionospheres and in providing evidence for the absence of magnetic field on Mars.

FUTURE PROGRAMMES

Various R&D programmes are constantly under review for realighment/reorientation in keeping with the national policies and mission-mode programmes. The Eighth Five-Year Plan period is visualized as a consolidation and reorganization phase, in keeping with the new technology policy on the anvil and the new mission programmes which are being formulated by the Planning Commission.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY/READY FOR TRANSFER

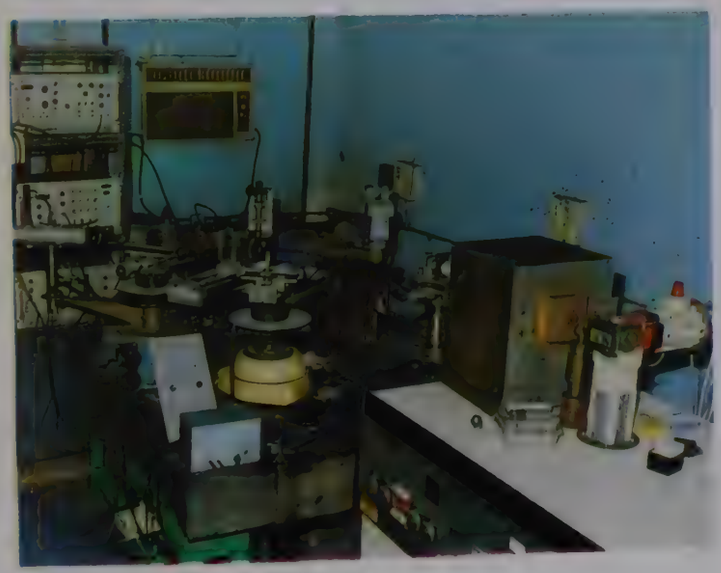
In addition to technologies developed for strategically and commercially important materials listed under 'Significant Achievements', the following technologies have also been transferred/ are ready for transfer to industry:

- Impregnating pitch for graphite electrodes
- Pitch coke for manufacture of carbon electrodes
- Cryogenic liquid level indicators
- Inductive voltage dividers
- Black stamp cancellation ink
- Electronic sequence controller for vacuum systems
- High frequency standard capacitors
- LCD displays
- Process for recovery of silver from waste hypo solution
- High power transducer materials
- Hot axle box detection system for safety and maintenance of railways
- Some of the beneficiaries of the technologies developed by NPL are: (i) M/s Assam Carbon Products Ltd, Gauhati; (ii) M/s Advance SIG Contacts, New Delhi; (iii) M/s Westinghouse Saxby Farmex Ltd, Calcutta; (iv) M/s Jyoti Refinery, Bombay; (v) M/s Weldon SIG Contacts, New Delhi; (vi) M/s Simplicity International, New Delhi; (vii) M/s Greyhound SIG Contacts, New Delhi; (viii) M/s Modison Metals Pvt. Ltd, Bombay; (ix) M/s Tilak International, New Delhi; (x) M/s Industrial Carbons, Calcutta; (xi) M/s Choksi Multimetals Pvt. Ltd, Udaipur; (xii) M/s Electroceramic Industries, Madras; (xiii) M/s Jagjiwan Enchem Udyog Ltd, Ah-

medabad; (xiv) M/s Rupindra Industries, New Delhi, (xv) M/s Stoplik Services (India) P Ltd, Bombay; (xvi) M/s J.D. Jones & Co (P) Ltd, Calcutta; (xvii) M/s INMARCO Industrial Maintenance (P) Ltd, Bombay; (xviii) M/s Graphites India Ltd, New Delhi; (xix) M/s Hindustan Hi-Tech Industries Ltd, Chandigrah; and (xxi) Defence Research & Development Organisation, Hyderabad.

MAIN FACILITIES

- Facilities for calibration of instruments/equipment of various types
- Instrumental facilities for characterization of materials in all aspects, viz., their composition, purity and structure. The instruments include: scanning electron microscope equipped with energy dispersive and wavelength dispersive spectrometers as microprobe analysis attachments (Jeol-JSM-35CF); Fourier transform infrared spectrometer (Digilab-FTS 20 E/U); X-ray fluorescence spectrometer (Rigaku-3070E); atomic absorption spectrometer (Varian-Spectra A-10 ABQ); electron paramagnetic resonance spectrometer (Varian-E-line Century Series); gas chromatograph (Perkin-Elmer-Sigma 2000); microprocessor controlled powder X-ray diffractometer (Siemens-D-500); and transmission electron microscope with scanning attachment (Jeol- JEM-200 CX)
- Facilities for evaluation of crystalline perfection of single crystals, high resolution X-ray diffraction techniques, diffractometry, topography, diffuse X-ray scattering and stress measurements



5-crystal X-ray diffractometer, designed, developed and fabricated at NPL for state-of-art level experiments

- Facilities for measurement of surface area and porosity
- Databases for long- and short-term forecasting in ionospheric and tropospheric communication; NPL has been serving as an Associate Regional Warning Centre (ARWC) as a part of an international system of rapid exchange of solar, magnetic and ionospheric data
- A well-stocked library
- Well-equipped mechanical and glass workshops

SERVICES OFFERED

NPL offers consultancy services to industry, R&D units, academic institutions and government agencies in the areas of its specialization, particularly relating to standards of physical measurements, radio communication, characterization of materials, acoustics including building acoustics and acoustic materials, superconducting materials and devices, and lamps and luminaries.

The laboratory undertakes calibration of measurement standards and measuring instruments & equipment at the highest level of accuracy (Echelon I) in the country, for various users such as government departments, defence, public & private sector industries and R&D institutions.

About 2000 certificates relating to calibration, developmental testing and analytical work are issued by NPL every year for instruments/equipment like loud-speakers, microphones, lamps and fluorescent tubes; aviation equipment including vacuum and pressure gauges and altimeters; audiometers; power generation, maintenance and distribution devices like power, phase and energy meters; thermometers and other temperature measuring devices (clinical and industrial); digital/analog voltmeters; current meter, resistance & capacitance measuring machines and devices; dimensional metrology equipment in precision machine tool industry for length, angle and gauge, etc.; and weighing machines, scales and weighing bridges.

TRAINING COURSES

The laboratory conducts training courses in the areas of its specialization. Under the auspices of the Commonwealth India Metrology Centre (CIMET), courses are organized with a view to assisting developing countries in the Commonwealth to improve their metrology facilities.

PUBLICATIONS

NPL publishes *NPL Technical Bulletin* (Quarterly), *Sameeksha* (Quarterly), *Ionospheric Data* (Quarterly), and its annual reports.

Contact Person: Director, NPL

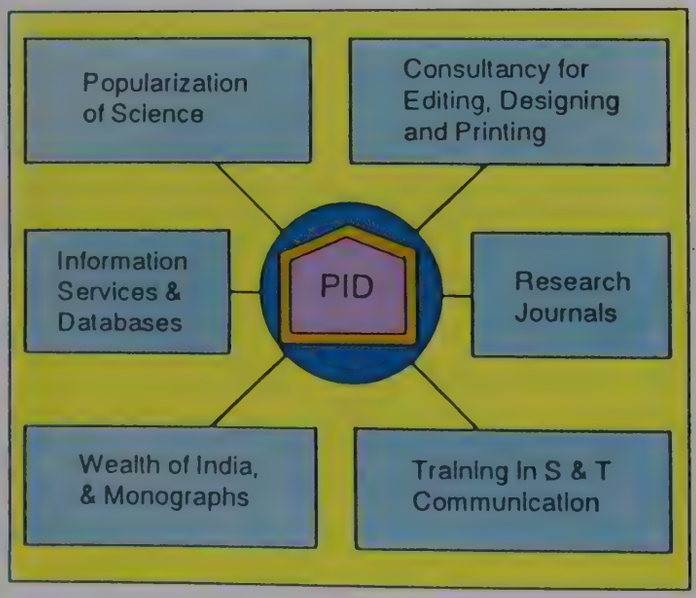
Publications & Information Directorate (PID)

Dr K.S. Krishnan Marg, New Delhi 110 012
Telephone: 5786301 Telegram: PUBLIFORM NEW DELHI
Telex: 031-77271 PID IN FAX: 5731353 E.Mail: pid @ sirnetd. ernet. in

Established: 1951
Director: Dr G.P. Phondke, M.Sc., Ph.D. (London)
Budget for 1992-93: Rs 439 lakh

MANDATE

- Providing formal linkages of communication among the scientific community in the form of research periodicals in different areas of science and technology
- Collection, collation and dissemination of information on plant and mineral wealth, and on industrial infrastructure of the country
- Setting up of specialized databases and providing information services to entrepreneurs, policy planners, agriculturists and research workers
- Dissemination of S&T information to the general public
- Providing consultancy services on editing, designing and printing of various types of S&T publications



MAJOR R&D PROGRAMMES

The R&D programmes being undertaken at PID are geared towards serving the communication needs of the different segments of the Indian society:

Dissemination of Information to Scientific Community — PID publishes a family of 11 research journals in the various disciplines of science and technology. Besides serving as communication links among scientists within India, these journals bring the work carried out by the Indian scientists to the attention of their peers abroad.

Wealth of India — The Directorate brings out encyclopedic publications on Indian raw materials, and monographs on specific topics. These publications serve as informative and reliable sources of reference for researchers, policy makers, industrial entrepreneurs, agriculturists and students. The Directorate has set up a Research and Specimen Cell which acts as a repository of economic raw materials.

Information Services — The two information services run by PID are: (i) Medicinal & Aromatic Plants Information Service (MAPIS), and (ii) Industrial Information Service (IIS). In addition to attending enquiries pertaining to the plants and Indian industries, the Directorate brings out an abstracting journal on aromatic and medicinal plants. PID is a national node of the Asian and Pacific Information Network on Medicinal & Aromatic Plants (APINMAP), the aim of which is to promote the exchange of information and resource among the 14 member countries.

Science Popularization — PID, in the recent past, has diversified its activities towards taking the science to the masses on a large scale. The science popularization programme of the Directorate now includes publication of popular science journals, monographs and books; publication of S & T encyclopedias, and Science Feature Service for newspapers.

SIGNIFICANT ACHIEVEMENTS

- The Directorate brings out special issues of the research journals, on topics of contemporary relevance. The issues brought out during the last couple of years include those on catalysis, Buckminster fullerenes, man-made fibres, contraception and reproductive biology, technology management and mathematical modelling in S&T.
- The *Wealth of India — Raw Materials* series is being revised and updated. Already three volumes of the revised series have been brought out. In addition, a large number of monographs on specific and composite topics have been brought out. Some of the recent ones are *Plants for Reclamation of Wastelands, Birds, Groundnuts* and *Indian Brassicas*.

Some of the popular science publications of PID

A view of the printing facilities at PID

- MAPIS database has been computerized and is available on-line to users not only in India but abroad as well.
- Under the Science Popularization Programme, ten books on scientific topics of general interest have been brought out. Published in English as well as in Hindi, these books have been very well received by the students and the general public. A scientific encyclopedia, *Golden Treasury of Science & Technology* has been also brought out. This encyclopedia, focuses on Indian contributions also, which receive scant attention in the usual publications of this type.

MAJOR FUTURE PROGRAMMES

Plans are afoot to strengthen the Industrial Information Service by building databases in the following areas: agro-industries, environmental risk analysis and pollution control, energy (non-conventional sources), waste utilization, food-processing industries and biotechnology.

Currently, PID's science popularization programme is based on print media only. But in due course, other modes of mass communication, such as electronic media, will also be made use of The popular science books being brought out in English and Hindi, will be published in some regional languages also.

MAIN FACILITIES

- Photo type-setting and DTP
- Offset printing
- Designing, layout and art
- Computerised databases
- Herbarium
- Library

SERVICES OFFERED

- Information services on medicinal & aromatic plants and on Indian Industry
- Consultancy for editing, designing and printing of S&T documents, brochures, books, journals, etc.
- Science feature service for the mass media
- Plant and crude drug identification
- Reprography services

TRAINING COURSES

Being a premier institute in the area of S & T communication, PID has infrastructure and expertise to train science writers, research workers, etc. in this segment. It conducts short-term training courses on scientific research paper writing, popular science writing and on herbarium techniques etc.

PUBLICATIONS

- **Research Journals**: *Journal of Scientific & Industrial Research* (monthly), *Indian Journal of Chemistry* (Sec-A) (monthly), *Indian Journal of Chemistry* (Sec-B) (monthly), *Indian Journal of Technology* (monthly), *Indian Journal of Experimental Biology* (monthly), *Indian Journal of Biochemistry & Biophysics* (bimonthly), *Indian Journal of Pure & Applied Physics* (monthly), *Indian Journal of Radio & Space Physics* (bimonthly), *Indian Journal of Marine Sciences* (quarterly), *Indian Journal of Fibre and Textile Research* (quarterly), and *Research and Industry* (quarterly)
- **Abstracting Journal**: *Medicinal & Aromatic Plants Abstracts* (bimonthly)
- **Encyclopaedic Publications**: *The Wealth of India-Raw Materials, Bharat ki Sampada - Prakritik Padarth*
- **Popular Science Journals**: *Science Reporter* (monthly), *Vigyan Pragati* (monthly), and *Science ki Duniya* (quarterly)
- **CSIR Newsletters**: *CSIR News* (semi-monthly). *CSIR Samachar* (semi-monthly).
- Advanced-level monographs on specific and composite topics

  Popular science books, monographs and encyclopedia.

Contact Person : Director, PID

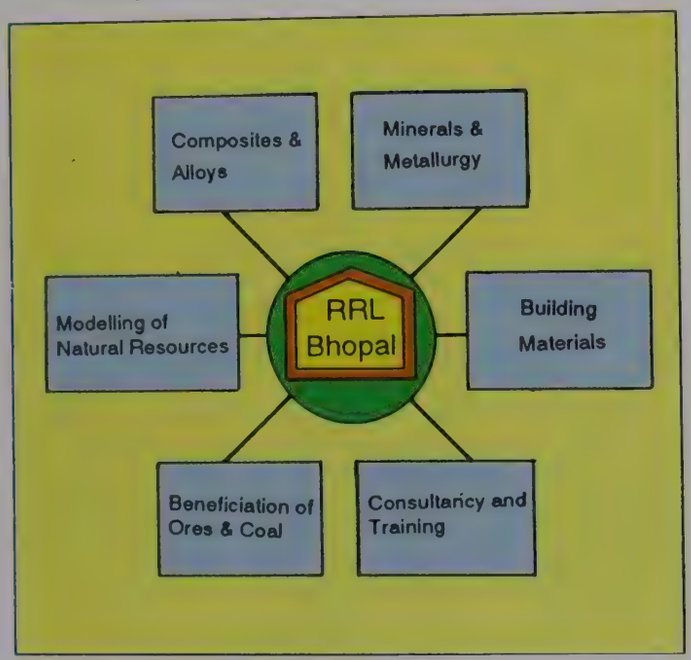
Regional Research Laboratory, Bhopal (RRL- Bhopal)

Hoshangabad Road, Near Habibganj Naka, Bhopal 462 026
Telephone: 547521, 547105, 547244, 547615 Telegram: RESEARCH BHOPAL
Telex 705-298 RRLB IN FAX: 0755 547042
E. Mail: rrlbho; @ sirnetd. ernet. in

Established : 1981
Director: Prof. T.C. Rao, Ph.D., MMGI, MIIE, FIE
Budget for 1992-93 : Rs 223 lakh

MANDATE

- To conduct R&D in the areas of building materials, minerals & metallurgy, material science, and natural resources of the region
- To provide S&T inputs for the economic and industrial development of the Madhya Pradesh region



MAJOR R&D PROGRAMMES

The major R&D programmes of the laboratory relate to: (i) development of low-cost/alternative building materials/components; (ii) development of new materials like metal-matrix and alloy based composites; (iii) tribological studies, e.g., wear-related problems in mining equipment, farm implements; (iv) ferrites from blue dust; (v) characterization of natural fibres, fibre-reinforced polymer materials; (vi) corrosion & engineering failure studies; (vii) quality -upgradation of foundary techniques, especially metal-based industry in tribal and backward sectors of M.P.; (viii) beneficiation of low grade ores and coal; (ix) utilization of fertilizer minerals of M.P., utilization of aluminium silicate minerals; (xi) natural resources database management; (xii) modelling studies on groundwater resources management and planning in various basins of M.P.; and (xiii) modelling studies on water quality.

SIGNIFICANT ACHIEVEMENTS

- Quality and productivity improvement of electrolytic tough pitch (ETP) copper welding for BHEL, Bhopal

Electrolytic tough pitch (ETP) copper welding

- Solving the problem of debonding of white metal pad to mild steel in hydrogenerator thrust bearings produced by BHEL, Bhopal
- Development of a simple quality assurance method for sodium etched PTFE tapes
- Studies of tensile properties of aluminium alloys and effect of inclusion content on mechanical properties and deep drawability of Al alloys
- Development of building components using red mud: A combination of red mud and sisal fibres in polymer matrix as alternative material for building components like doors, door panels has been developed. Door panels (3mm thick) of this composite have shown equivalent flexural strength of a 10-12 mm thick plywood (510 kg/cm^2). The unique feature of the new

technology is the use of natural fibres in place of expensive glass fibres

- Development of clay ash bricks
- Beneficiation and industrial utilization of fertilizer minerals of M.P., e.g., silicone rock phosphate and dolomite rock

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- A process for the manufacture of Al alloy graphite particulate composite material (M/s Diamond Auto Industries, Ghaziabad)
- Pilot production of red mud polymer components (M/s M.P. Polymers Ltd, Bhopal; M/s La Kozy Interior Decorators, Bombay)

TECHNOLOGIES IN THE OFFING

- Unglazed ceramic wall tiles based on pyrophyllite
- Alternative building materials/components such as clay fly ash bricks, red mud cementitious binder, natural fibre cement roofing sheet
- Hard ferrites based on blue dust from Bailadila

MAJOR FUTURE PROGRAMMES

Major programmes of the laboratory will be on squeeze casting of Al alloy for automotive components, squeeze infiltration process for Al alloy ceramic fibre composites for engineering applications, production of ceramic fibre preforms, tribological studies of mining and farm implements for improved performance, beneficiation of low-grade rock phosphate for fertilizer industry, and red mud polymer materials as wood substitute for building materials/components.

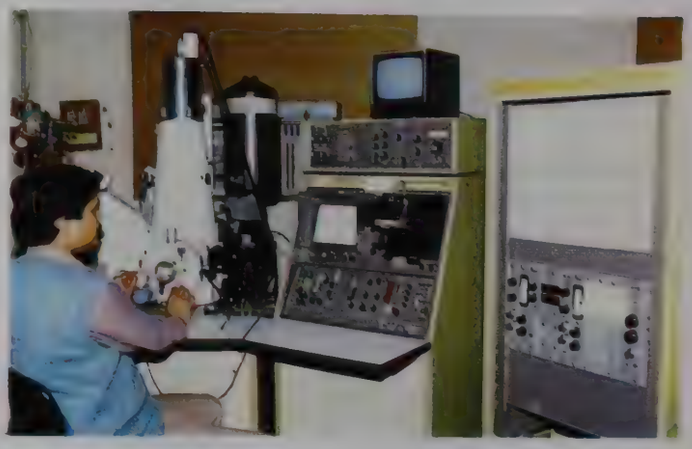
MAJOR FACILITIES

RRL has modern equipment and instrumentation for chemical analysis, mineral processing, mechanical testing and metallography in addition to well-equipped foundry, workshop, etc. The instruments/equipment include: scanning electron microscope; X-ray diffractometer, TAS Plus image analyzer, atomic absorption spectrometer, DCP spectraspan, simultaneous thermal analyzer, particle size analyzer, INSTRON Universal testing machine, stress rupture testing machine, friction and wear testing machine, rubber wheel abrasion tester, gas jet erosion tester, bearing test rig, Talysurf apparatus, fatigue testing machine, pressure die-casting machine, melt spinner, 150T hydraulic press, high temperature furnace, plasma spray unit, computer facilities.

SERVICES OFFERED

In order to ensure user involvement right from inception to the various stages of development, RRL undertakes contract research, e.g., sponsored collaborative and grant-in-aid projects from industry, public sector undertakings, government agencies and institutions.

Air-jet erosion tester



Scanning electron microscope

Consultancy services in the area of expertise of the laboratory and technical services comprising testing and analysis, training, assistance of advisory nature, etc. are also extended.

TRAINING COURSES

The laboratory conducts training courses for personnel from R&D organizations, industry and academic institutions in its areas of activity.

PUBLICATIONS

The laboratory brings out its house bulletin (half-yearly) and annual reports.

Contact Person: Dr R.N. Yadava, Head, Resource Development Division

Regional Research Laboratory, Bhubaneswar (RRL-Bhubaneswar)

Bhubaneswar 751 013
Telephone: 51126, 51227, 51437, 51638 & 57639 Telegram: RESEARCH BHUBANESWAR
Telex: 0675-275 ABC RRL IN FAX: 0674-51164

Established: 1964
Director: Prof. H.S.Ray, M. Tech (Metall. Engg.), Ph.D.
Budget for 1992-93: Rs 380 lakh

MANDATE

- Characterization of minerals, beneficiation of lean and complex ores and agglomeration of ore fines and concentrates
- Pyro- and hydro-metallurgical extraction of metals, preparation of alloys and recovery of metal values from wastes
- Development of special materials and composites
- Preparation and synthesis of organic and inorganic chemicals from marine, forest and mineral resources
- Design and development of process equipment and control systems
- Survey, introduction and utilization of aromatic, medicinal and other economic plants

MAJOR R&D PROGRAMMES

The major R&D programmes of RRL (Bhubaneswar) relate to mineral processing, extraction metallurgy (pyro and hydro), preparation of special materials and alloys, design and project engineering, preparation of inorganic and organic chemicals (including pigments, drugs, pharmaceuticals and perfumery chemicals); survey & cultivation of aromatic, medicinal and other economic plants; and development of new analytical methods.

SIGNIFICANT ACHIEVEMENTS

- Development of sparger system for flotation column using acoustic energy

Multihearth furnace for reduction roasting studies

- Mineralogical and chemical characterization of limestone deposits
- Petrological studies on Talcher coal and granite samples of Orissa
- Studies on production of cement clinkers using down draft sintering technique
- Reduction roasting of sodium sulphate using pan roaster facility
- Reduction roasting of ilmenite in an oil fired rotary kiln
- Engineering consultancy on settling up of 75 tonnes/h iron ore crushing and screening plant
- Utilization of Mahua flowers for the production of oxalic acid, alcohol and lactic acid
- Separation of eutrained titania (TiO_2) from ferrous chloride solution
- Leaching of blue dust and processing of leach liquor to obtain highly pure $FeCl_3$ in solution for ferrite production
- Natural methane campaign - methane emission measurement from paddy crops

Inflight plasma processing of zircon sand

- Recovery of graphite and tungsten values from Tapeskonda graphite bearing quartz vein deposits of Andhra Pradesh
- Cleaning of zinc rougher concentrate by adoption of flotation column

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Extraction and purification of saponin from soapnuts (*Sapindus mukorossi* and *S. emargi natus*) (NRDC, New Delhi)
- Portable metallic multifuel stoves:
  (a) Multifuel stove of community size (Model Harsha)
  (b) Single pot fixed chulha (model SK-3) and double pot fixed chulha (model SK-1)
- Coal fired pottery kiln
- Production of 2,4-dihydroxyquinoline and nickel-azo-yellow methyl anthranilate
- Synthetic iron oxide black and red (Fores Chemical Industries Thani, Tamilnadu).

MAJOR FUTURE PROGRAMMES

The future programmes of RRL(Bhubaneswar) will be directed towards technology development for extraction of valuable and strategic metals from ores and concentrates, polymetallic manganese nodules; production of ferro alloys through plasma; commissioning of pipeline for high-concentration slurry transportation; energy from biomass; metal recovery from wastes/byproducts of metallurgical and chemical industry; high temperature pigment; treatment of contaminated soil, solids and effluents of the different mines and industrial sites; bioactive substances from marine organisms; agrotechnology for cultivation of aromatic, medicinal and other economic plants like *kewda, Hevea brasiliensis* (rubber), *Simarouba glausa* (Aceituns), cymbopogon species, vetiver and patchouli.

MAIN FACILITIES

- High precision microscopes for mineral characterization studies
- Large - scale flotation column for beneficiation of various minerals and coal fines, gravity separation units including Bartle's Mozley concentrators and magnetic separators
- Integrated facilities for communition of ores and minerals and studies on energy consumption
- Facilities for agglomeration of ore fines and concentrates through sintering, pelletization, briquetting, testing and evaluation of the agglomerates
- Rotary kilns, multiple hearth furnace, high temperature Tamman furnace, vacuum induction furnace, etc. for roasting, smelting and melting studies

Autoclave for pressure leaching studies

25-Stage solvent extraction unit

- High pressure batch and continuous autoclaves for slurry leaching
- Integrated solvent extraction and electrowinning facilities for extraction of metals from dilute and complex solutions
- Solid-liquid separation facilities for generation of engineering data
- Special high temperature furnaces, including plasma furnace
- Test loops for slurry transportation through pipelines including bench-scale facilities for material characterization, slurry rheology, dewatering, pumping and mixing studies
- Combustion test rig for liquid fuels, acoustic and other types of burner testing
- Cyclone combustion test rig
- Sophisticated corrosion-erosion testing facilities
- Facilities for surface area, porosity and fluorescence measurements, and catalyst testing and evaluation
- Instruments for physico-chemical characterization of ores, minerals and organic chemicals: XRF, XRD, AAS, IR, UV, NMR, GLC, ion chromatograph, HPLC and densitometer
- Herbarium for identification of plants
- Library and computerized information system

Improved variety of lemongrass

SERVICES OFFERED

The laboratory offers consultancy services to mining, metallurgical and chemical industries; research and educational institutions, and undertakes contract research in the areas of its activities. The laboratory also provides analytical and testing services to the industry.

TRAINING COURSES

The laboratory organizes training programmes on cultivation of aromatic and medicinal plants and supplies planting materials of superior genotypes and technical knowhow to the prospective growers.

PUBLICATIONS

The laboratory publishers *RRL Bulletin* (quarterly) and its annual reports.

Contact Person: Shri J.R. Sahu, Head, Planning, Information, Library, Documentation and Computer Application Division, RRL (Bhubaneswar)

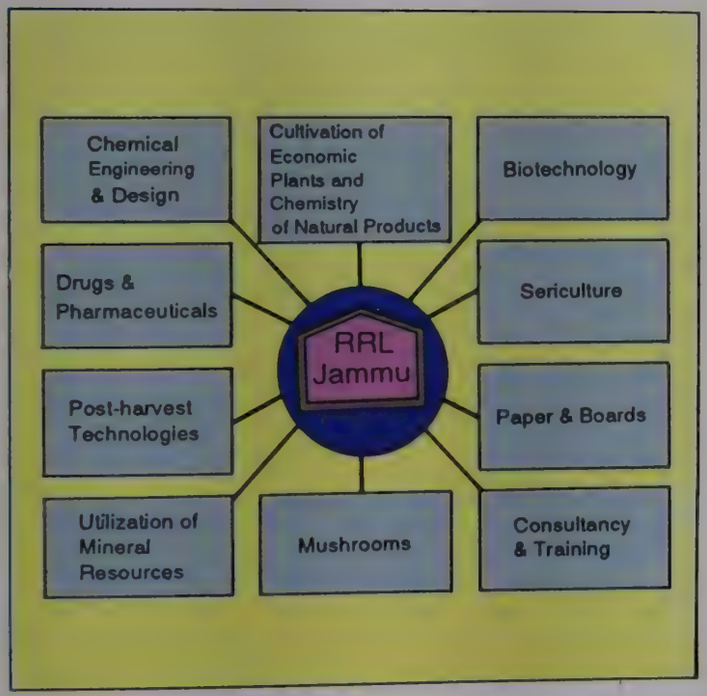
Regional Research Laboratory, Jammu (RRL-Jammu)

Canal Road, Jammu Tawi 180 001
Telephone : 46368, 46383, 5540, 72084, 72051, 72002 & 44382 Telegram : REGLAB JAMMU
Telex : 377-231 RRL IN FAX : 191-48607

Established: 1957 (Taken Over)
Director: Dr R.S. Kapil, Ph.D.
Budget for 1992-93: Rs 299 lakh (B.E.)

MANDATE

- To carry out R&D work with a view to helping in industrial development of the North-western region of the country
- To help in optimal utilization of natural resources
- To explore and exploit hitherto untapped resources of the region
- To provide consultancy, testing and equipment design/fabrication facilities to entrepreneurs, industrial establishments and government developmental agencies



MAJOR R&D PROGRAMMES

The major R&D programmes of RRL-Jammu relate to natural products & organic chemistry, drugs & pharmaceuticals, process development & engineering design, introduction, improvement and cultivation of medicinal and aromatic plants, plants survey, post-harvest technology, applied microbiology & mutation genetics, food technology, cellulose, pulp & board, and utilization of mineral resources.

SIGNIFICANT ACHIEVEMENTS

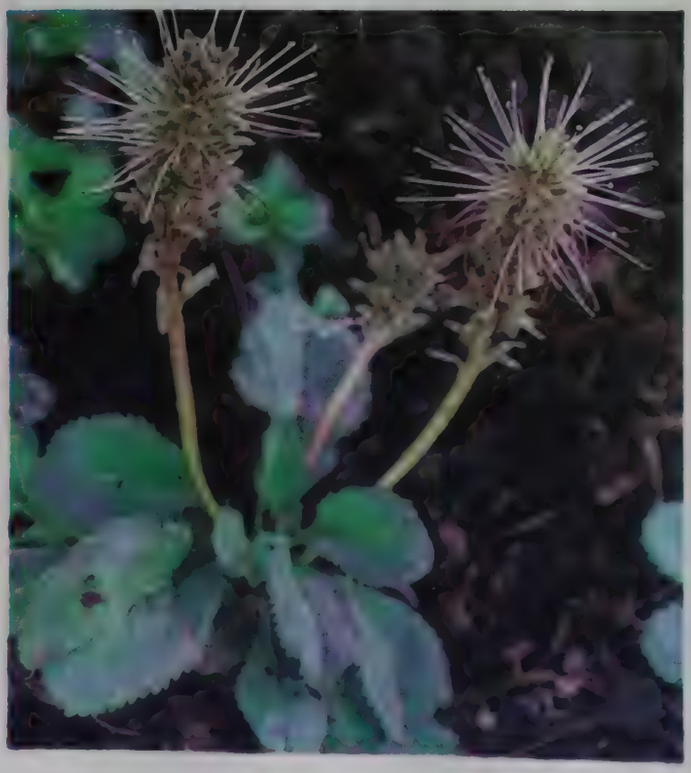
- Development of a new improved variety of lemongrass, CKP-25
- Cultivation of hops, an important ingredient for beer industry has been successfully introduced in the North-west region
- Introduction of improved species of clocimum and jamrosa, based on genetic manipulation
- Introduction and development of mushroom: cultivation at cottage scale in J&K and Sikkim
- Development of a complete package for the production of diosgenin
- Two new drugs, (i) antiarhthiritic drug derived from oleoresin of *Boswellia serrata* (Sallai guggul), and (ii) a hepatoprotective formulation are already in market
- Development of a process for value-added products based on turpentine oil
- Development of a linalool-rich oil containing strain of *Ocimum canum*, which gives an annual yield of 230 kg/ha oil; it has been accepted as an alternative source of linalool by the industry
- Development of a process for isolation of natural pigments safflower yellow and carthamine
- Standardization of a process for the extraction of podophyllotoxin from *Podophyllum emodi* at a pilot plant level
- Development of technology for mechanical harvesting, post- harvest handling, storage and improvement of shelf-life of saffron
- Development of ready to use products of *anardana*; preparation of food products, where sugar has been replaced by other additives, for persons having diabetic problems
- Design and development of a semi-automatic plant for manufacturing gypsum coir boards

Heating of a barrack at Puga using geothermal energy

- Development of technologies for fish and mushroom cultivation, rabbit farming and processing of sheep and fur skins
- Economic exploitation of mineral wealth of the region, e.g., clays and potassium from Tsokar Lake and borax from Pugga Valley

MAJOR TECHNOLOGIES TRANSFERRED

- Technology for manufacture of aroma chemicals, viz., geraniol, citronellol and terpeniol (a plant based on this technology installed in Vietnam)



Picrorhiza kurroa — the herb is antiperiodic, stomachic and laxative; RRL-Jammu has domesticated this crop in Srinagar

RRL – Jammu has developed a novel technique for clonal propagation of Himalayan yew (*Taxus baccata*) — a source of anti-cancer drug 'Taxol'

- Technology for natural dyes and pigments (a plant fabricated and commissioned at Ho Chi Minh, Vietnam)
- Technology for production of diosgenin from dioscorea [plants installed for the governments of West Bengal and Tamilnadu, and the Central Research Organization (CRO), Rangoon, Myanmar]
- Technology for the production of menthol (CRO-Rangoon)
- Technology for fractionation of Java citronella oil (plant installed in West Bengal)
- Technology for production of pine needle boards (H.P. Government)
- Agrotechnology on hops (M/s Dewan Modern Breweries Ltd, Jammu)
- Knowhow for fruits and vegetable processing (M/s G. D. Industries, Bhopal)
- Technology for the manufacture of medium density fibre boards (M/s Nu Chem Agro Products, Tohana)
- Technology for the manufacture of 3,4,5-trimethoxybenzoic acid (M/s Numex Chemicals, Pathankot; M/s Alpha Drugs India Ltd, Chandigarh; M/s Finorg Chemicals Ltd, Chandigarh)

TECHNOLOGIES READY FOR TRANSFER

- Technology for the production of particle boards
- Technology for the production of boric acid and boron trifluoride

- Technology for the production of fortified rosin size, hydrogenated rosin, metal rosinates, alkyl rosins, etc. for paper and textile industry
- Technology for the production of the phytochemicals colchicine and podophyllotoxin
- Technologies for the production of the drugs 16-dehydropregnenalone acetate (16-DPA); 3,4,5-trimethoxybenzoic acid; dehydroepiandrosterone (DHA); miconazole; nifedipine
- Foods, jams and jellies for diabetic patients
- Natural food colours
- Solar drier for fruits & vegetables

MAJOR FUTURE PROGRAMMES

The major future programmes of the laboratory will focus on microbial conversion of steroids, and development of microbial products of industrial importance. The activities pertaining to exploitation of the natural resources of the region will be strengthened. Keeping in view the world trends, the laboratory will lay emphasis on herbal development and herb-based drugs. Other major programmes will relate to increasing the silk yield, and insect physiology and defence mechanism for developing safe insect control agents.

MAIN FACILITIES

- A wide range of analytical and characterization facilities, e.g., IR, UV-VIS spectrophotometers; FT-NMR spectrometer; mass spectrometer; CD & ORD equipment; GLC, HPLC

Paper sheet forming machine at RRL-Jammu

- DNA transilluminator
- Isotope laboratory
- Pilot plant facilities in the areas of fermentation, phytochemicals, food, minerals, papers & boards
- Well-equipped workshop
- Computer facilities
- Herbarium of the flora of North-west India
- Library

SERVICES OFFERED

RRL-Jammu undertakes sponsored research related to its areas of activity, and provides equipment design/fabrication facilities to entrepreneurs/industrialists.

The laboratory offers facilities for testing of drugs, essential oils, minerals and cellulosics, and biological standardization of pharmacological products. The laboratory also supplies seeds, seedling, plant materials and spawn for mushroom cultivation to farmers.

The laboratory undertakes market surveys with regard to availability of raw materials and requirements of finished products; and prepares technoeconomic feasibility reports based on the technologies developed by the laboratory.

TRAINING COURSES

RRL-Jammu conducts short-term training courses on cultivation of aromatic & medicinal plants, hops, mushrooms; rabbit farming; aquaculture, water quality assessment, and mineral and plant- based products.

PUBLICATIONS

The monographs/books brought out by the laboratory in the recent past include: Monographs—*Asparagus Cultivation, Himalayan Heracleum Linn. (Hogwood) - A Review*; Books — *Cultivation & Utilization of Medicinal Plants, Cultivation & Utilization of Aromatic Plants, Indian Mushroom Science, Chemistry and Pharmacology of Vasicine: A new oxytocic and abortifacient.* In addition, the laboratory has brought out survey reports on: *Essential Oil and Perfumery Industry in North India and Rose and Rose Oil Industry in India.*

The laboratory also brings out a newsletter, and its annual reports.

Contact Person: Director, RRL-Jammu

BRANCH LABORATORY & FIELD STATIONS

Regional Research Laboratory (Branch)
Sanat Nagar, Srinagar 190 005

Regional Research Laboratory (Extension Centre)
Palampur, Himachal Pradesh

RRL Field Research Station
(Experimental Farm)
Chatha, Jammu Cantt.

RRL Field Research Station
(Experimental Farm)
Verinag, Kashmir

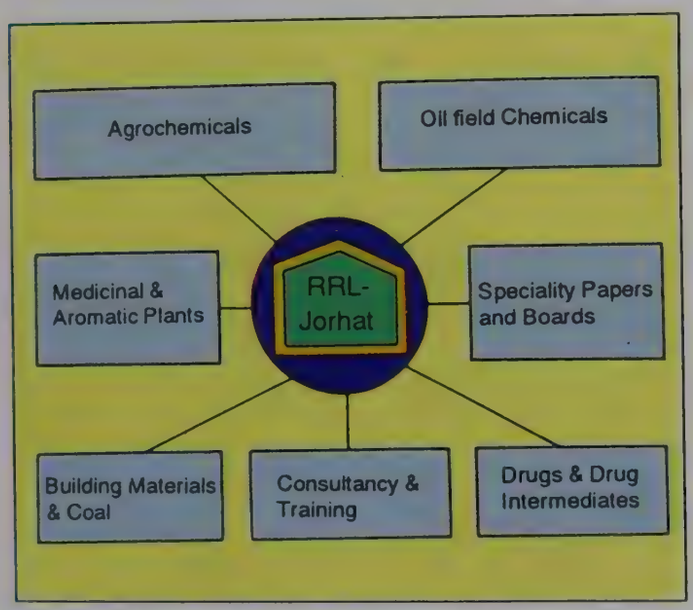
Regional Research Laboratory, Jorhat (RRL-Jorhat)

Jorhat 785 006
Telephone: 320315, 320353 & 320692 Telegram: RESEARCH, JORHAT
Telex: 0287-204 RRL IN FAX: 0376-321158

Established: 1961
Director: Dr Anil C. Ghosh, M.Sc., Ph.D.
Budget for 1992-93: Rs 512 lakh

MANDATE

- To provide R&D inputs for the effective use of the material resources of the North-Eastern region in particular and the country in general
- To help in the economic development and industrialization of the North-Eastern region in particular and the country in general
- To function as a link between the state organizations and other national laboratories on S & T problems requiring specialized attention



MAJOR R & D PROGRAMMES

The major R&D programmes of RRL, Jorhat include development of oil field chemicals, agrochemicals, drugs and drug intermediates, cellulose, pulp and paper, inorganic chemicals and building materials. The laboratory has also continued basic research in the area of organic chemistry, biochemistry and geoscience.

SIGNIFICANT ACHIEVEMENTS

- Development of agrotechnologies on medicinal and aromatic plants which have made citronella cultivation and extraction a major industry in the N.E. region, with a turnover of 500 tonnes of oil annually and employment generation for 20,000 persons in the rural sector

A citronella oil distillation plant in a village of upper Assam

- Development of a series of pour point depressants for the pipeline transportation of high waxy crude oil
- Development of vertical shaft kiln for mini cement plants; 29 such mini cement plants, set up on turn-key basis, are producing around 1.8 lakh tonnes of cement annually
- Development of a cationic polyelectrolyte which when added to the oil-water emulsion helps in breaking up of emulsion and quantitative separation of oil
- Process development for pesticides like phosphamidon, quinalphos, and chlorfenvinphos; isolation and characterization of compounds of plant origin with insecticidal and antifeedant properties
- Process development for caffeine from tea waste, diosgenin from dioscores spp and solasodine from *Solanum khasianum*
- Process development in the areas of speciality papers and boards including thermographic paper, carbonless copy paper, direct copy paper, carbon paper, gummed paper tape, and ceiling boards
- Development of chrome lignite as a vital drilling mud additive used to achieve and maintain desired

rheological properties of water-based drilling mud at high temperature; development of oil well formation clay stabilizer, sodium lignosulphonate, HPHT additive and high strength propellant

- Development of beneficiation additives for iron ore fines, geomicrobiological technique for petroleum prospecting, bacterial plant growth promoter, molecular sieve from paddy husk
- Establishment and maintenance of seismic surveillance network in the highly earthquake prone North-Eastern region.

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

- Phosphamidon and quinalphos (Sudarshan Chemicals Industries Ltd, Pune; NOCIL, Bombay; Vardan Ltd, Calcutta; Voltas Ltd, Secunderabad)
- Oil well cement additive (Hico Products, Bombay)
- Pour point depressant (Hico Products, Bombay; Hindustan Insecticide Ltd, New Delhi)
- Cationic polyelectrolyte (Poly Products, Guwahati)
- Carbonless copy paper (Strobel Industries, Nizamabad; Chiragdeep Paper Innovators Pvt. Ltd, Bhopal)
- Caffeine from teawaste (North East Caffeine Industries Pvt. Ltd, Jorhat)
- VSK mini cement plant (29 parties).

A view of VSK mini cement plant of M/s Prag Shiva Cement, Guwahati, based on RRL–Jorhat technology

TECHNOLOGIES READY FOR TRANSFER

- Pour point depressant
- Chrome lignite
- Phosphamidon and quinalphos
- Caffeine from tea waste
- Diosgenin from dioscorea spp
- VSK mini cement plant
- Carbon paper, carbonless copy paper, thermographic paper, and direct copy paper

MAJOR FUTURE PROGRAMMES

The major future programmes of RRL-Jorhat will relate to: (i) development of chemicals for enhanced crude oil recovery and polymeric drilling mud additives, (ii) development of process knowhow for pesticides—metaxyl and anilophos, drugs and intermediates, bioactive principles from plants of N.E. region, (iii) thermal paper for fax machines, (iv) computer-aided upgradation of VSK mini cement technology and (v) cold bonded pelletization.

MAIN FACILITIES

- Facilities for the analysis of water, soil and sand, metal and minerals, cement fertilizers, food products, essential oils, etc.
- A wide range of modern instruments for characterization and structure determination of chemicals and geochemical studies
- Computer facilities

SERVICES OFFERED

The laboratory offers consultancy services to industry and R & D units both within and outside the region, including foreign countries. It offers techno-economic feasibility studies, testing & analytical services and undertakes contract research for technology development and transfer in the fields of biochemicals, building materials, coal & petroleum, drugs & pharmaceuticals, inorganic chemicals, medicinal & aromatic plants, mini & tiny cement plants, oil field chemicals, pesticides & organic chemicals, and speciality papers & boards.

TRAINING COURSES

The laboratory conducts training courses for industry, R & D organizations and educational institutions in the areas of its activity. The laboratory also offers training in computers, civil engineering, industrial safety and risk analysis.

PUBLICATIONS

The laboratory publishes its annual reports and the *RRL News* (monthly).

Contact Person: A.K. Hazarika, Head, Information & Liaison.

BRANCH LABORATORY

RRL Branch, Itanagar, Naharlagun P.O. Itanagar, Arunachal Pradesh

FIELD STATIONS

RRL Jorhat Experimental Farm, Yaongyimsen Village P.O. Changtongya, Dist. Mokokchung, Nagaland

RRL Jorhat Experimental Farm, Mantripukhuri Dist. Imphal, Manipur

SEISMIC SURVEILLANCE STATIONS

(Conventional Stations)

Jorhat, Guwahati, Haflong, Kaziranga, Kohima, Yaongyimsen, Itanagar, Bomdila, Khonsa

TELEMETRY STATIONS

Panbari, Jorhat, Chanki, Bhandari, Kongon, Dolmukh.

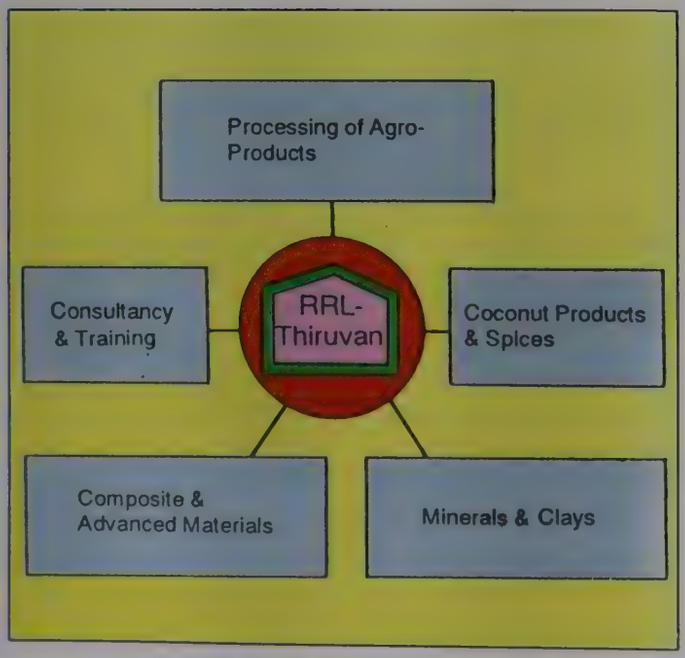
Regional Research Laboratory, Thiruvananthapuram (RRL-Thiruvananthapuram)

Thiruvananthapuram 695 019
Telephone: 75324, 76774 Telegram: CONSEARCH
Telex: 0435-232 IN FAX: (0471) 75186
E. Mail: rrlt @ sirnetb. iisc.ernet in

Established : 1978
Director: Dr A.D. Damodaran, Ph.D. (Leeds)
Budget for 1992-93: Rs 415 lakh

MANDATE

- To carry out multidisciplinary R&D work with a view to promoting industrial development of the region based on its natural resources
- To provide consultancy/advisory inputs to industries for upgradation of skills and productivity and to government departments in the discharge of their development/control functions
- To help in human resource development in the area of S&T in collaboration with universities and allied research institutions of the region



MAJOR R&D PROGRAMMES

The major R&D programmes of RRL-Thiruvananthapuram relate to chemistry of natural products, agro-processing and speciality agrochemicals related to spices and plantation crops; (ii) materials screening/processing for value addition of clays & non- nuclear beach sand minerals; (iii) oxidic fine ceramics; metal alloys & composites, photochemical systems including solar energy conversion, (iv) calibration/upgradation of procedures for analysis of pollutants; and (v) waste water technology.

SIGNIFICANT ACHIEVEMENTS

- Setting up of the first indigenous edible grade palm oil extraction plant at Pedavegi (A.P.) under the National Oil Seeds Mission
- Development of novel coconut products of high value such as coconut cream and milk
- Development of semolina flour and food products from cassava
- Development of natural fibre-polyester composites, metal matrix composites and alloys

TECHNOLOGIES TRANSFERRED

Technology transfer has been effected for a series of value-added spices products, e.g., dry packed green pepper, canned green pepper, fractionation of chilli oleoresin, etc., with state-of-art capability, including waste water treatment to required norms.

TECHNOLOGIES READY FOR TRANSFER

- Shelf-stable coconut cream
- 'POLYCOIR', as a wood substitute for door panels, acoustic panels, etc.; also available in moulded shapes
- Zeolite 4A as a detergent builder & 'CLAYCLEAN' for rural water softening
- High grade synthetic rutile
- Value-added spice products, including encapsulated and fresh flavours

Palm oil extraction plant commissioned at Pedavegi (A.P.)

- Aerospace quality aluminium alloy castings for ISRO/VIKAS engine
- Al-alloy matrix composites for self-lubricated bodies

MAIN FACILITIES

- A wide range of analytical instruments for characterization of organic/inorganic/polymer compounds, metals & alloys, ceramic powders and sintered bodies, etc.
- Mechanical testing, metallography, electron microscopy, and X-ray units
- Selected mineral processing equipment and other facilities required for the processing of materials of various origin

SERVICES OFFERED

The laboratory provides technical consultancy to industries, governmental agencies in its areas of expertise. It undertakes chemical analysis of minerals and food materials, evaluation of sands used in foundries, and physical characterization of materials.

TRAINING PROGRAMMES

Special training courses can be offered on quality control of inorganic/organic substances, fermentation practices, premium quality aluminium alloy castings, etc.

Contact Person: Director, RRL - Thiruvananthapuram.

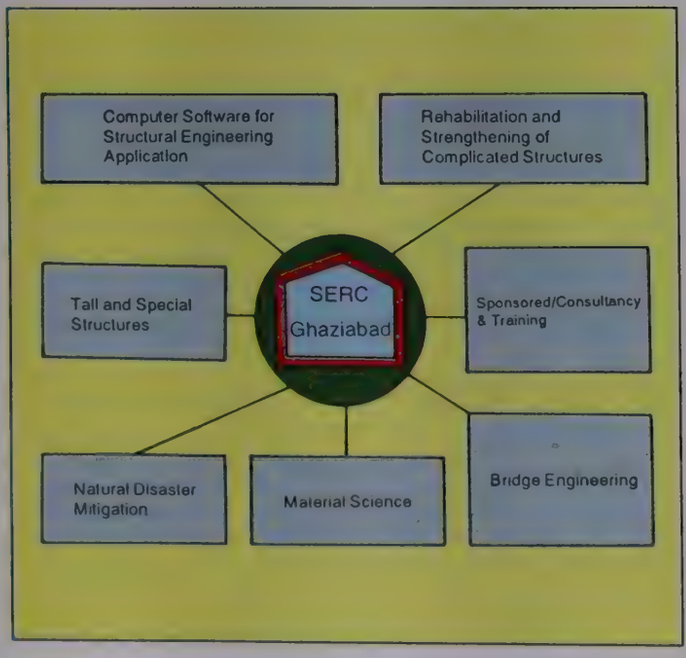
Structural Engineering Research Centre (SERC, Ghaziabad)

Sector 19, Kamla Nehru Nagar, Ghaziabad 201 002
Telephone:8-721874 & 8-713772 Telegram : SERCENTRE GHAZIABAD
Telex: 0592-204 SERC IN FAX: 011-8-721882 & 0575-721882
E. Mail: sercg@sirnetd.ernet.in

Established: 1965 (initially established at Roorkee; shifted to Ghaziabad in 1987)
Director: Dr D.N. Trikha, Ph.D.
Budget for 1992-93: Rs 250 lakh

MANDATE

- To undertake basic and applied research on various aspects of structural engineering, e.g., bridge engineering, wind engineering, tall structures and special structures, natural disaster mitigation and material science
- To take up sponsored R&D work for public and private organizations, especially with regard to computer-aided analysis and design, monitoring of important bridges and other structures, by actual field measurements, tests on scaled models, etc.
- To undertake consultancy assignments involving analysis and design of complex structures
- To develop comprehensive computer software for structural engineering applications
- To act as an information bank for the expert knowledge and knowhow on the design and construction of a wide range of complex and innovative structures
- To organize short-term specialized courses in structural engineering disciplines for practising engineers



MAJOR R&D PROGRAMMES

The major R&D programmes of the institute are in the areas of tall and large span structures (bridges), specially on analysis and design of superstructure of bridges, their aerodynamic behaviour and distress diagnostics of existing bridges. The Centre also has research programme on natural disaster mitigation related to wind and earthquake.

SIGNIFICANT ACHIEVEMENTS

- Development of software for detailing of reinforced and prestressed concrete bridges for the Ministry of Surface Transport (MOST)
- Performance studies on the super-structure of Taj Mahal through theoretical and field studies for Archaeological Survey of India
- Assessment of structural behaviour of reactor buildings for Narora and Kakrapara Atomic Power Projects of the Nuclear Power Board
- Field studies on the well foundations of Ganga Bridge at Varanasi for MOST
- Performance studies on the superstructure of two Mandovi bridges at Goa for MOST
- Development of software packages for:
  - Assessment of loads of RC chimneys and cooling towers
  - Analysis and design of free-standing tubular triangular microwave towers
  - Elastic analysis of rotationally symmetric structures
  - Elastic analysis of high rise buildings including design of RC columns and beams
  - WIND-LDR for the assessment of wind loads on structures
- Development of ferro-cement structures for rural and urban use under the National Missions on Drinking Water and Oil Seeds

MAJOR TECHNOLOGIES TRANSFERRED TO INDUSTRY

SERC's technologies for the manufacture of ferrocement water tanks, septic tanks, digesters, bins, bio-gas holders, roofing units and manhole covers have been released to 60 firms through NRDC

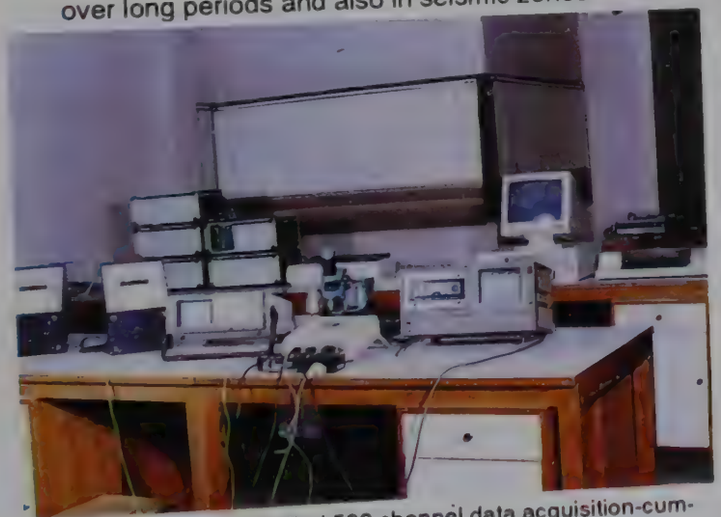
TECHNOLOGIES READY FOR TRANSFER

- Software packages for the analysis and design of tall (buildings, lattice towers, chimneys & cooling towers) and bridge structures
- Ferrocement technology for rural and urban areas
- Distress diagnostics of existing bridges through field instrumentation

MAJOR FUTURE PROGRAMMES

The future R&D programmes of SERC will be directed towards:

- Developing capabilities for analysis and design of bridges, their distress diagnostics, rehabilitation and strengthening
- Rationalized assessment of wind loads on structures like dwellings, industrial structures (chimneys & cooling towers), lattice towers and TV towers for their wind resistant design
- Developing design capabilities for structures subjected to cyclones/earthquakes
- Setting up of an industrial wind tunnel - a national test facility
- Field monitoring of bridges, buildings, industrial structures and tall structures for their behaviour under wind, over long periods and also in seismic zones



Microprocessor controlled 500 channel data acquisition-cum-analysis system for capturing and processing static signals from strain gauges, inductive & capacitative transducers

MAIN FACILITIES

- A wide range of modern instrumentation for the destructive and non-destructive testing of structures and components in laboratory and field
- Main-frame computing facility
- An industrial wind tunnel
- Dynamic-cum-heavy test laboratory for the component and scaled model tests under static and reversal loadings (under- construction)

SERVICES OFFERED

- SERC offers design and consultancy services to the government departments, public sector undertakings and private organizations. The Centre also undertakes contract research from the industry on specific problems.
- The Centre undertakes field monitoring of long-term behaviour of structures subjected to wind and earthquake.
- The Centre provides laboratory scale investigations on materials, structural components and scaled models under static and reversal loadings.
- The Centre carries out wind tunnel investigations on structures and industrial complexes for the building industry.
- The Centre undertakes development of dedicated software packages related to structural engineering problems.

Small industrial wind tunnel facility

TRAINING COURSES

The Centre conducts training courses for industry, R&D organizations, educational institutions and private organizations in the areas of its activity.

Contact Person: Shri B. K. Tripathi, Information Officer

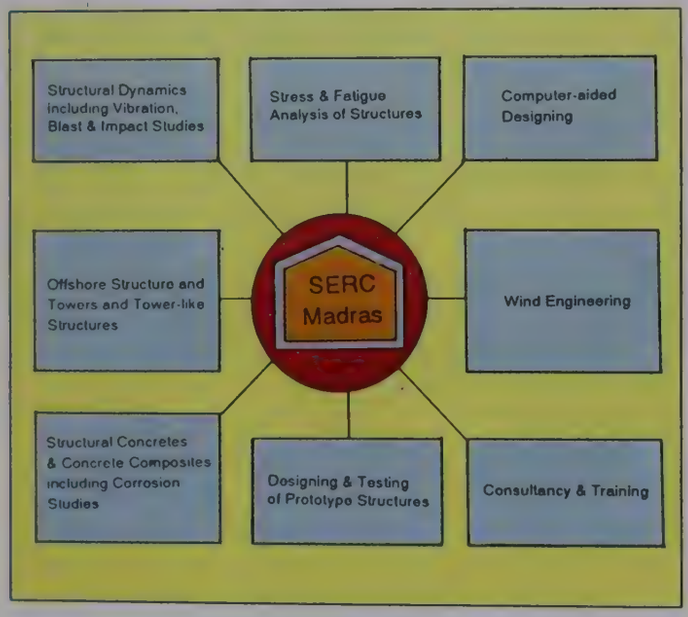
Structural Engineering Research Centre, Madras (SERC-Madras)

CSIR Campus, TTTI, Taramani P.O. Madras 600 113
Telephone: 2352139 Telegram: SERCENTER MADRAS
Telex: 041-8906 CSIR IN 041-8798 TTRS IN FAX: 2350508
E.Mail: sercm @ sirnetm. ernet. in

Established: 1965
Director: Shri N.V. Raman, B.E. (Civil Engg.), M.Engg. Sc. (Struct. Engg., Melbourne)
Budget for 1992-93: Rs 373 lakh

MANDATE

- To carry out application-oriented research and develop knowhow on analysis. design, construction and testing of all types of structures
- To undertake contract/consultancy work related to structural designs
- To act as a clearing house for the latest knowledge in its areas of activity
- To conduct training courses for in-service engineers.

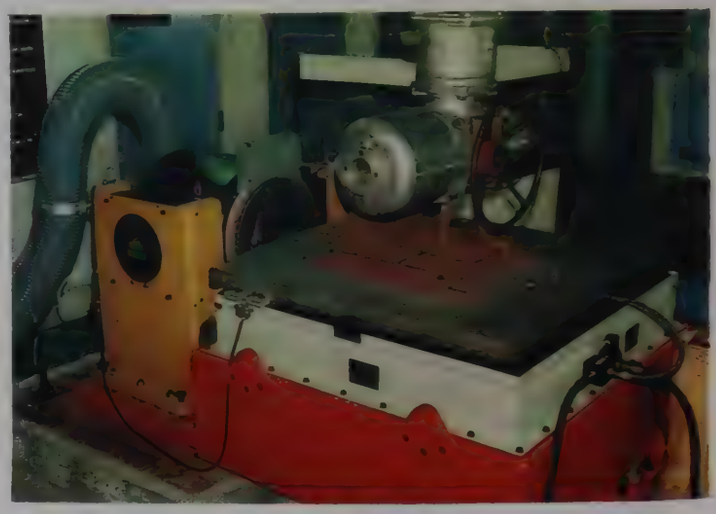

Structural Dynamics including Vibration, Blast & Impact Studies
Stress & Fatigue Analysis of Structures
Computer-aided Designing
Offshore Structure and Towers and Tower-like Structures
SERC Madras
Wind Engineering
Structural Concretes & Concrete Composites including Corrosion Studies
Designing & Testing of Prototype Structures
Consultancy & Training

MAJOR R & D PROGRAMMES

The major R & D programmes of the Centre relate to structural dynamics, including studies on vibration, blast and impact; experimental mechanics; wind engineering; computer-aided designing; offshore structures; structural concretes & concrete composites; and towers and tower-like structures.

SIGNIFICANT ACHIEVEMENTS

- Risk analysis of cyclonic wind speeds - development of cyclonic wind speed maps for the coastal regions of India
- Diagnosis of vibration problems and recommendations for repair of different power plant structures including conveyor gallery structures, crusher foundations, and TG installations



Hydraulic slip table with a valve actuator under plant vibration test

- Development of designs for aircraft pen structures in steel to resist blast and impact loads
- Analysis and design of launcher structures for two missiles, *Agni* and *Trishul*, for Ministry of Defence; based on structural analysis carried out by the Centre, the launcher structures have been modified for making them reliable, safe and reusable for both the missiles
- A three-dimensional photoelastic analysis of trunnion block of main battle tank, for Combat Vehicle Research & Development Estt., Madras
- Development of a superior, abrasion-cum-impact resistant material, SIFCON (slurry infiltrated fibre reinforced concrete) which has vast potential for application in the construction of blast-resistant structures
- Development of designs of laced reinforced concrete blast- resistant structures for the Defence authorities and full-scale blast testing of structures at TBRL, Chandigarh

Fatigue investigation on offshore structural component (Y joint)

- Assessment of static and fatigue strength of stiffened steel tubular joints used in offshore structures; testing and evaluation carried out for the Institute of Engineering and Ocean Technology & ONGC
- Fatigue life assessment of welded rail joints produced by different thermit welding industries, as inputs to Research Design and Standards Organisation, Min. of Railways
- Application of the artificial intelligence (AI) techniques for the development of knowledge-based expert systems (KBES) for design applications in structural engineering: EXTASY for microwave towers, and KASTLE for transmission line towers
- Establishment of Building Centres in cooperation with Housing and Urban Development Corporation (HUDCO) at Quilon, Palghat, and Trivandrum in Kerala; Madhuravoyal, Madras; and Pondicherry
- Analysis of dynamic response of a 100 m high guyed tower and also the critical wind loads on the tower considering the elastic stability of the tower-guy system, for SHAR Centre, Sriharikota, Dept. of Space

Tower Testing & Research Station Facility of SERC, Madras (test on Canadian transmission line tower)

- State-of-the-art tower testing carried out for Ontario Hydro, Canada for a 500 kV slim-line tower, which included special 'double twist loading' for the test
- Development of design criteria for structures reinforced with stainless steel bars, for the Directorate of Naval Projects, Visakhapatnam and design of Strong Rooms using fibre reinforced concrete, for the Reserve Bank of India, Madras
- Development of fifteen interactive software packages for structural analysis and design
- The Department of Telecommunications, Govt. of India, New Delhi, has stipulated SERC-M's authentication of design of 15 m self-supporting masts and 40 m towers as a precondition for tower manufacturers in India to participate in Government tender

TECHNOLOGIES READY FOR TRANSFER

- Fabrication of space joints and structures formed using them
- Precast and prestressed flooring and roofing elements

- Prestressed concrete poles
- Polymer overlays for industrial floors, clock slabs and pavements
- Designs for machine foundations for turbo-generators
- Designs for natural draught cooling towers & chimneys and shell roofs
- Designs for water tanks and pipes
- Software packages for design of building structures

MAJOR FUTURE PROGRAMMES

The major future programmes of the Centre will be in the following areas: analytical and experimental studies in structural dynamics; analysis and design of steel structures including transmission line towers and ship structures; CAD, expert systems and parallel processing applications in structural engineering; development of expertise on wind effects on structures under cyclonic storms by wind tunnel studies and field experiments on prototype structures, in the areas of natural hazard mitigation; and development of special concretes and concrete composites.

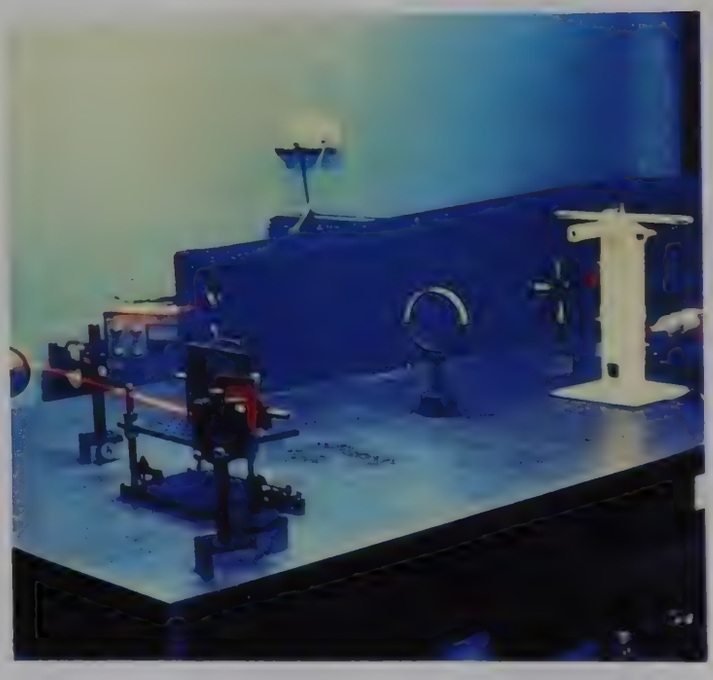
The focal theme of the projects in the area of concrete composites and products will be new construction materials/products which will enhance the durability/service life of structures even under aggressive/hostile environments (like marine, chemical, etc.). The main thrust in the area of construction engineering will be on studying corrosion of reinforcement in concrete, and assessment of strength of structures in distress, as also development of suitable techniques for repairing such structures.

A UNDP project on Engineering of structures for mitigating damage due to cyclones has been recently taken up by the Centre.

MAIN FACILITIES

- Heavy testing laboratory with a heavy duty test floor for testing prototype structures
- Concrete composites laboratory with a chemical laboratory, polymer impregnation equipment and testing machines
- Experimental stress analysis laboratory with equipment for techniques such as photoelasticity, holographic interferometry, speckle interferometry, and moire fringes (for strain measurement)
- Structural dynamics laboratory with a medium duty test floor and uniaxial shaking-table facility having servo-controlled electro- hydraulic actuator of 100 kN capacity with facilities for high speed data acquisition and control
- Fatigue testing laboratory with heavy-duty floor and reaction walls, and servo-controlled electro-hydraulic

Heavy Testing Laboratory at SERC, Madras



Laser holography set-up at the Experimental Mechanics Laboratory of SERC, Madras

actuators of 500 kN & 1000 kN capacities with facilities for on-line data acquisition and control

- Computer centre equipped with a multi-terminal, 32-bit PRIME computer with graphics-facilities. UNIX based mini computers for CAD work; multiprocessor system with 4 CPUs, 32 MB globally shared memory and 1GBB disk storage for developing parallel computing software for structural and graphic analysis

A view of the Computer Centre at SERC, Madras

- Construction engineering laboratory with an outdoor casting yard and pretensioning bed and non-destructive testing equipment

SERVICES OFFERED

The Centre offers consultancy services to public and private sector organizations on specific problems relating to analysis, design, construction and testing of models/prototype structures and structural components. An illustrative list of beneficiaries/clients includes:

GOVERNMENT SECTOR : Combat Vehicle R & D Estt., Avadi, Madras; Defence Research & Development Organisation, New Delhi; Department of Telecom. (Microwave Project), Bombay; Heavy Vehicles Factory, Madras; Indira Gandhi Centre for Atomic Research, Kalpakkam; Military Engg. Service, Garrison Engr., Madras; Nuclear Power Board, Bombay; Naval Projects - Director General, Vizag; Reserve Bank of India, Madras; Research & Development Establishment (Engrs.), Pune; SHAR Centre, Sriharikota (A.P.); Southern Railways; Tuticorin Port Trust, Tuticorin.

PUBLIC SECTOR : Bharat Heavy Electricals Ltd, Tiruchy; Dredging Corporation of India, Cochin; Engineers India Ltd, Madras; Hindustan Shipyard Ltd, Vizag; Instrumentation Ltd, Palghat; National Thermal Power Corporation, New Delhi; Nuclear Power Corporation, Bombay; National Mineral Devt. Corpn, Bailadilla, M.P.; Oil & Natural Gas Commission, Bombay; South Eastern Coalfields Ltd, Bilaspur; Tuticorin Thermal Power Project, Tuticorin; Visakhapatnam Steel Plant, Vizag.

PRIVATE SECTOR : Ashok Leyland Ltd, Madras; Audco India Ltd, Madras; Advanced Radio Masts Pvt. Ltd, Hyderabad; Beacon Rotork Controls Ltd, Madras; Gammon India Ltd, Neyveli; Gold Star Steel & Alloy Ltd, Hyderabad; Larsen & Toubro Ltd, Madras; MECON, Hyderabad; SAE (India) Ltd, New Delhi; Tata Iron & Steel Co. Ltd, Jamshedpur; Torsteel Foundation in India, Bangalore; Tirumala Tirupati Devasthanams, Tirupati; WS Industries Ltd, Madras.

FOREIGN : Locweld Inc Iber Ville, Canada.

TRAINING COURSES

The Centre functions as an advanced school for structural engineering by organizing short-term specialized courses for engineers not only from India but also from several other countries. SERC is a full member of the International Council for Building Research Studies and Documentation (CIBB), Netherlands, and Renewable Energy Resources Information Centre (RERIC), Bangkok, Thailand.

PUBLICATIONS

The Centre publishes *Journal of Structural Engineering* (an international research & development journal, published quarterly), *SERC Newsletter* (quarterly) and handbooks, brochures, technical reports and its annual reports.

Contact Person Dr K.R. Sridharan, Head, Information.

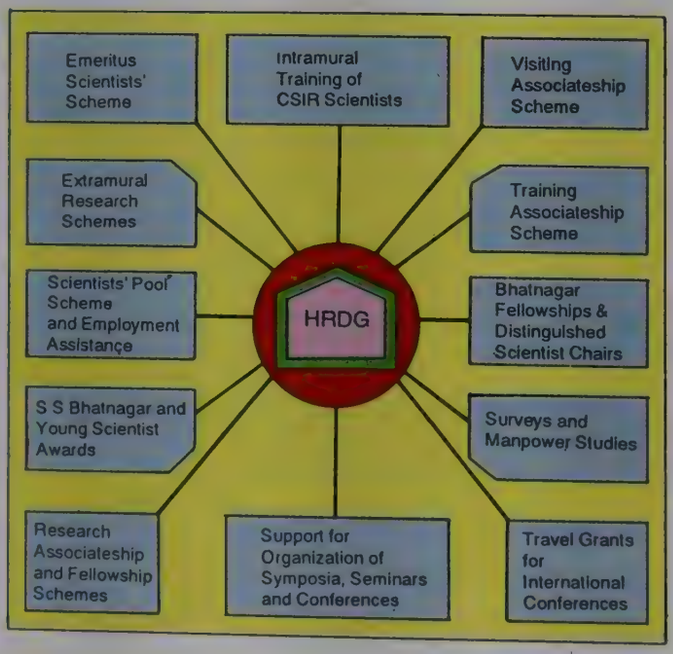
Human Resource Development Group (HRDG)

CSIR Complex, NPL Campus, Pusa, New Delhi 110 012
Telephone : 5743481, 5784990 TELEGRAM: CONSEARCH NEW DELHI
Telex : 31-77312 CSIR IN
E. Mail : csirx @ sirnetd. ernet. in

Established : 1989
Head : Dr Sushil Kumar, M.Sc., Ph.D.
Budget for 1992-93 : 2650 lakh

MANDATE

- To support extramural research and thereby science & technology related manpower development in the country
- To conduct training courses for CSIR scientists and technical personnel for the sake of retraining and reorientation
- To conduct surveys and studies on availability and utilization of S&T manpower


Emeritus Scientists' Scheme
Intramural Training of CSIR Scientists
Visiting Associateship Scheme
Extramural Research Schemes
Training Associateship Scheme
Scientists' Pool Scheme and Employment Assistance
HRDG
Bhatnagar Fellowships & Distingulshed Scientist Chairs
S S Bhatnagar and Young Scientist Awards
Surveys and Manpower Studies
Research Associateship and Fellowship Schemes
Support for Organization of Symposia, Seminars and Conferences
Travel Grants for International Conferences

MAJOR R&D PROGRAMMES

The R & D programmes of HRD Group, in general, relate to development of S&T manpower in India through funding of research projects, award of research fellowships, funding of symposia/seminars, etc., and fostering of excellence in research through presentation of awards for excellent research work done in India.

The HRD Group also carries out: (i) evaluation of the impact of extramural research support being provided by CSIR to the universities and other institutes of higher learning, (ii) development of training and educational programmes for manpower development, and (iii) dissemination of information relating to availability and utilization of S&T manpower in India and abroad, and compilation of comprehensive information on CSIR scientists and their achievements.

SIGNIFICANT CONTRIBUTIONS

- HRDG provides financial help in the form of junior/senior research fellowships & research associateships to bright young researchers with a view to promoting growth of S&T manpower in the country. So far around 40,000 research fellowships/associateships have been awarded to researchers working in various departments of universities, PG colleges, IITs, etc. In addition, HRDG awards research grants to non-CSIR laboratories for overall improvement of quality of research in the country.
- Temporary placement is provided to unemployed but highly qualified scientists/ engineers, many of them with foreign training, under the scheme 'Scientists Pool'. More than 18,500 persons have availed of this facility.
- Efforts are being made to tap the expertise of non-resident Indian scientists and technologists for strengthening the R&D system and industrial development of the country through the programmes TOKTEN (Transfer of Knowledge/Knowhow Through Expatriate Nationals) and INRIST (Interface with Non-Resident Indian Scientists and Technologists).
- Joint projects taken up by scientists from universities, industries and CSIR laboratories are funded through a scheme of 'Visiting Associateships'.
- Financial assistance is provided to superannuated scientists after their superannuation with a view to making use of talented and experienced researchers for the advancement of science.
- Distinguished scientist chairs are created, and Bhatnagar Fellowships awarded with a view to recognizing

sustained record of research and establishing nuclei of excellence in research in various areas of S&T.

- National-level symposia/seminars/conferences are funded, and travel grants provided to researchers for participating in important international symposia/seminars/conferences.
- Excellence in S&T research is recognized through the award of Shanti Swarup Bhatnagar Prizes in the areas of Biological; Chemical; Earth, Atmospheric, Ocean and Planetary; Engineering; Mathematical; Medical and Physical sciences. SSB Prize, which is the most coveted honour for an Indian scientist, has been awarded to 270 scientists/ engineers, so far.
- Young researchers within the CSIR system are encouraged through the 'Young Scientists Awards'.
- Popularization of science is promoted by funding popular science journals in English and Indian languages.
- Surveys and manpower studies have been carried out on the availability and utilization of S&T manpower.

FUTURE PROGRAMMES

The major objectives of HRDG in future will be to increase efficiency and effectiveness of S&T manpower through new and on-going research support programmes and create opportunities for training in new research techniques and education in frontier areas.

TRAINING COURSES

HRDG organizes training/re-orientation courses for junior and middle-level scientists and management training for senior level scientists of the CSIR labs/institutes.

PUBLICATIONS

- *Directory of CSIR Scientists*
- *Degree Holders & Technical Personnel Survey-1981*
- *Outturn of S&T Manpower in India: 1947-83*
- *Technical Manpower* (Quarterly)

Contact Person: Dr Sushil Kumar, Head, HRDG

International Scientific Collaboration (ISC)

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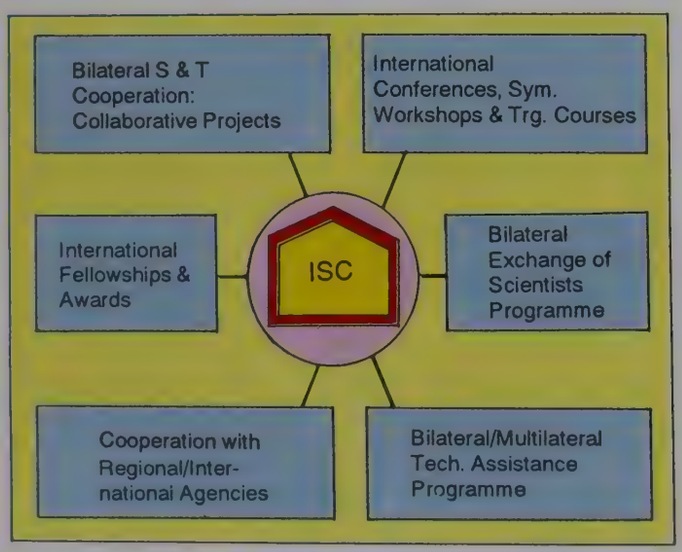
MANDATE

- To stimulate scientific & technological cooperation between CSIR and its counterparts abroad through bilateral/multilateral cooperation and exchange programmes
- To promote taking up of joint scientific & technological projects by CSIR and its counterparts abroad in areas of common interest, on cost sharing basis
- To facilitate sharing of laboratory facilities and S&T information at international level
- To facilitate training of CSIR scientists abroad in the use of sophisticated techniques and instruments in the frontier areas of science and training of foreign scientists in India, particularly in CSIR laboratories


Bilateral S & T Cooperation: Collaborative Projects
International Conferences, Sym. Workshops & Trg. Courses
International Fellowships & Awards
ISC
Bilateral Exchange of Scientists Programme
Cooperation with Regional/Inter-national Agencies
Bilateral/Multilateral Tech. Assistance Programme

MAJOR ACTIVITIES

Bilateral Cooperation

With a view to developing closer relations with other friendly countries in the field of science and technology, CSIR has established formal relationships in the form of bilateral agreements/protocols for exchange of scientists and for scientific and technical cooperation.

CSIR's bilateral programmes for exchange of scientists with the following foreign agencies are monitored by the ISC Unit: British Council; Centre National de la Reserche Scientifique (CNRS) of France; and German Academic Exchange Service (DAAD) of FRG.

Besides the programmes on exchange of scientists, CSIR has concluded several scientific and technical cooperation programmes, covering specific areas with projects identified for laboratory to laboratory cooperation. The foreign agencies with which CSIR has such S&T programmes are: Czechoslovak Academy of Sciences; Polish Academy of Sciences; State Committee for Research & Technology, Bulgaria; National Council for Science and Technology, Romania; Kernforschungasanalage (KFA), FRG; Deutsche Forschungs-und fur Luft-und Raumfarht (DLR), FRG; Max Planck Society (MPG), FRG; Scientific Research Council, Iraq; ARE Academy of Scientific Research and Technology, Egypt; Scientific and Technical Research Council (TABTAK), Turkey; Nigerian Building & Road Research Institute; Royal Scientific Society, Jordan; Netherlands Applied Scientific Organization (TNO); Sudan National Council for Research; New Zealand Department of Scientific & Industrial Research; Thailand Institute of Scientific & Technological Research (TISTR); Institut Francais Du Petrole (IFP), France; Bangladesh Council of Scientific & Industrial Research (BCSIR); National Institute of Health, USA; State Committee for Science & Technology (GKNT), USSR; Imperial Cancer Research Fund of UK; National Council of Science & Technology (CONCYTEC), Peru; National Council for Scientific Research (NCSR) of Vietnam; Department of Industry, Technology and Commerce of Australia (DITAC); State Bureau of Technical Supervision (SBTS) of China; National Natural Science Foundation (NSFC) of China; Scientific Studies and Research Centre (SSRC) of Syria; Science and Technology Division of Bangladesh; and Mongolian Academy of Sciences (MAS).

The main features of these agreements are: exchange of scientists and experts to share scientific experience, mutual consultations, participation in science conferences and meetings, etc; collaboration on research and development projects of mutual interest identified jointly; fellowships for training of young scientists, etc.

UNDP and Bilateral Assistance Programmes

CSIR has participated in the India (UNDP) Country Programmes 1972-77, 1978-85; 1985-90 and 1990-95 and various Bilateral Technical Assistance and Cooperation Progammes of the Government of India. These have been useful in setting up integrated R&D facilities in CSIR

laboratories in new priority areas of research with package of assistance consisting of expert services, training facilities and specialized equipment not available in the country. Some of the areas for which assistance from UNDP has been received are mircoelectronics, material synthesis, turbomachinery, bioengineering and coal gasification.

Indo-US Projects

CSIR is participating in the Indo-US Sub-commission on Science and Technology under which financial assistance has been received for specific R&D projects from the US India fund. The important areas covered include chemotherapy of cancer, surface analytical techniques, standards, high strength ferrous alloys, etc.

Indo-British Projects

A number of collaborative S&T projects have been undertaken with the help of various British agencies. The projects include plant tissue culture, fibre optics-based instrumentation, hydrolytic enzymes, catalysis etc.

Indo-French Projects

Government of India and France have set up Indo-French Centre for Promotion of Advanced Research (IFCPAR) in New Delhi to promote science and technology cooperation between India and France. IFCPAR is assisting in the implementation of several projects in various areas of S&T, e.g., natural products, polymers, ceramic matrices, zeolite catalysts, superconducting thin films, etc.

Indo-EEC Projects

Under the Indo-European Economic Community cooperation programme, financial assistance is being provided for S&T projects on superconductors and conducting polymers.

Participation Agreements signed by Other Indian Agencies with their Foreign Counterparts

CSIR participates, with respect to areas/items of its interest, in the agreements finalized by the Department of Science and Technology, Department of Culture and the Indian National Science Academy, with their foreign counterparts.

Cooperation with International Organizations

Commonwealth Science Council

CSIR represents the Government of India on the Commonwealth Science Council (CSC), London. India is currently the Chairman of CSC for the biennial period 1992-94. It is actively participating in the CSC's regional coordinated research programmes like the Chemical Research and Environmental Needs (CREN) which has seven components, viz., atmospheric acidification, environmental impact of fertilizer use, gaseous emission from biogenic and other sources, pesticide residues, chemical transport processes and sediments in rivers, air pollution modelling and environmental analytical techniques. India is the lead country for two of the component projects, i.e., gaseous emissions and pesticide residues in the project CREN in which, besides India, countries like Australia, Malaysia, Pakistan, Bangladesh, Srilanka, Papua New Guinea and Singapore are participating.

Workshops, training courses and seminars under various projects are arranged in India as part of Indian contribution.

Association for Science Cooperation in Asia (ASCA)

CSIR represents India on the Association for Science Cooperation in Asia (ASCA) since its inception in 1970. Some of the areas identified for active collaboration among ASCA member countries are human resource development, exchange of information on science & technology and development of national capabilities in the fields of environmental science & technology and material science & technology, etc.

UNESCO

The Council cooperates with the Indian National Commission for Cooperation with UNESCO with regard to the work of the Science Sub-commission of UNESCO, particularly in relation to the Inter- government Oceanographic Commission, scientific documentation and information including UNISIST/ASTINFO/APINMAP programmes, science policy, and ecological, biological & geological sciences.

WAITRO

CSIR is a member of the International Institute of Refrigeration and World Association of Industrial and Technological Research Organization (WAITRO).

IDRC

CSIR and International Development Research Centre (IDRC), Canada, have an understanding for training of research scientists in CSIR laboratories and providing expert services from CSIR to IDRC projects in other developing countries. IDRC has also been assisting CLRI- Madras for Phase II study on meat and slaughter- house byproduct systems.

SAARC

CSIR is actively involved in the S&T cooperation programme of SAARC (South Asia Association for Regional Cooperation). It has organized workshops, training programmes and meetings in areas like groundwater exploration; food processing; medicinal plants; low-cost housing; management of leather industry; pesticides and documentation, at various CSIR laboratories.

UNU

The United Nations University (UNU), has associated one of the CSIR laboratories, namely, Central Food Technological Research Institute (CFTRI), Mysore, for advanced training & research in post-harvest technology under its World Hunger Programme. The programme provides for multidisciplinary applied training to senior fellows from developing countries in food conservation with

special reference to household and the rural sectors through improved techniques and innovations in handling, storage and processing.

Another programme concluded with UNU provides for training of UNU fellows in CSIR laboratories in the area of biotechnology & microelectronics. Both these programmes have been extended up to 31 December 1993.

International Training Programmes of CSIR

Some of the CSIR laboratories conduct regional/international courses/workshops sponsored by UN bodies and CSC from time to time.

CSIR laboratories also receive trainees from other developing countries under the ITEC programmes of the Government of India and under sponsorship of specialized UN agencies and CFTC. PID provides training to science editors from developing countries, sponsored by International Development Research Centre, Canada.

International Fellowships/Awards of CSIR

CSIR has instituted and offered its contribution towards several fellowships of international organizations:

INSA/COSTED/FASAS Fellowships

These are open to the members of the Federation of Asian Scientific Academies & Societies (FASAS), namely Sri Lanka, Nepal, Philippines, Malaysia, China, Thailand, Pakistan, Bangladesh and Afghanistan for exchange visits of up to three months duration.

Fellowships

CSIR contributes partially towards fellowships awarded by CSC in respect of attachment abroad of Indian fellows and to foreign fellows for their attachment in CSIR laboratories.

J.C. Bose & S.K. Mitra Awards

These travel fellowship awards are given to Indian young scientists to enable them to participate in General Assembly meetings of International Union of Radio Sciences (URSI) which is one of the ICSU unions.

Fellowship Scheme for Developing Countries

CSIR has launched this scheme to provide an opportunity to the scholars from developing countries to pursue their higher studies leading to Ph.D. in India, in CSIR labs.

Raman Fellowship for CSIR Scientists

Since 1988, CSIR has been awarding Raman Research Fellowship to young scientists to allow them to work in any lab of their choice abroad, in emerging areas for a period of up to nine months.

Travel Grants

Apart from arranging participation of scientists from laboratories of CSIR in important international conferences, CSIR also provides partial financial assistance towards travel for scientists belonging to other research organizations and universities for participation in international scientific conferences which are of direct interest to CSIR and to which CSIR has not deputed any of its own scientist.

Technology Utilisation Division(TUD)

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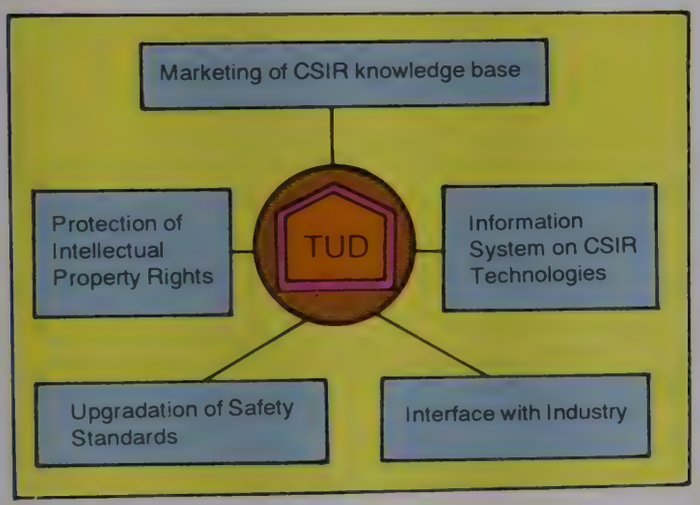
Head: Dr H. R. Bhojwani, Ph.D.

MANDATE

- Promoting and facilitating the marketing and commercialization of CSIR's knowledgebase and services
- Catalyzing business development by interfacing with national level industry associations, user agencies, financial institutions and technology licensors
- Securing and safeguarding CSIR's Intellectual Property Rights (IPRs)
- Maintaining information/database on CSIR's R&D output and marketable knowledgebase and its utilization
- Enhancing the level of standards of safety in labwork



MAJOR PROGRAMMES

- *Marketing of Knowledgebase*

(a) Facilitating the marketing of CSIR knowledgebase by:

(i) devising protocols, procedures and guidelines for marketing different components of knowledgebase,

(ii) assisting laboratories in negotiation and drafting of legal instruments for contracting different components of the knowledgebase, and

(iii) bringing out video films, publications, brochures, reports on diverse activities and achievements of CSIR.

(b)Enhancing CSIR capability for business development & marketing of knowledgebase by:

(i) helping to establish Marketing/Business Development Groups at the laboratory level, and

(ii) sensitizing and training of CSIR personnel in different aspects of marketing the knowledgebase.

- *Interfacing with Industry and Other Constituents in the Innovation Chain*

(a) Actively interacting with all India level industrial associations such as Federation of Indian Chambers of Commerce and Industries (FICCI), Associated Chamber of Commerce (ASSOCHAM), Confederation of Indian Industries (CII), Indian Chemical Manufacturers Association (ICMA), Indian Drug Manufacturers Association (IDMA); technology transfer agencies such as NRDC, BCIL and financial institutions such as TDICI, ICICI, etc., by jointly arranging seminars, workshops, exhibitions in general, as well as specific industrial sectors.

(b) Assisting local small and medium sized industrial units in identification and solving of their scientific and technological problems through seven Polytechnology Transfer Centres (PTCs) set up in state capitals.

- *Securing Intellectual Property Rights (IPR) for CSIR's Knowledgebase*

Securing, through the Patent Unit of the Division, IPRs for CSIR's R&D output, viz., Indian and foreign letters of patents, registration of designs, copyrights and trademarks and also providing protection against infringement of the IPRs secured.

- *Maintaining an Information System on CSIR's Research Output and its Utilization*

Databases have been established on:

(a) processes/knowhow/designs and patents developed by CSIR laboratories,

(b) processes/knowhow/designs and patents licensed and commercialized,

(c) contract research (yearly)—ongoing and completed-and

(d) consultancy services in CSIR laboratories (yearly) — ongoing and completed.

- *Improving and Upgrading Safety Standards in CSIR*

As the CSIR laboratories undertake R&D work at international level, their protocols and practices for safety in laboratory work should also attain the same level; therefore, a project on 'Improving and Upgrading Safety Standards in CSIR' has been launched, for which the World Bank has provided a grant, inter alia with the objectives of :

(a) assessing the level of safety standards/practices in laboratories,

(b) devising and specifying protocols for safety in lab work for different areas of R&D and reviewing their implementation,

(c) maintaining a database on aspects of adherence to safety in CSIR laboratories,

(d) creating an awareness for laboratory safety and organising training programmes in laboratory safety systems, and

(e) collecting and disseminating information on developments in laboratory safety-standards, equipment, etc.

SIGNIFICANT ACHIEVEMENTS

The Division has made noteworthy contributions towards creating an awareness and climate for business development and marketing within CSIR and for projecting CSIR's knowledgebase and expertise, both in India and abroad. Some of the other achievements include:

(a) devising 'Model Agreements' for contracting different components of CSIR knowledgebase thereby devolving autonomy to the laboratories to deal with the IPR contracts expeditiously at their level

(b) executing broad MoUs with several large companies, e.g., M/s American Cyanamid, USA and M/s Du Pont, USA for screening and developing new compounds for agricultural pests control, ONGC for collaborative projects at unit levels, etc.

(c) synergizing the strength of CSIR system to undertake multi- laboratory consultancy assignments; for example, setting up of an Analytical Chemical Laboratory for the Gas Processing Plant of the Gas Authority of India Ltd at Guna in Madhya Pradesh

(d) carrying out fire safety audit of three of the CSIR laboratories in association with outside experts, which has now generated in-house competence to undertake fire safety audit of other CSIR laboratories

(e) organizing training programmes for senior CSIR personnel with a view to making them aware of the implications and impact of changing economic, political and intellectual property scenario on R&D

(f) creating an on-line database on Indian Patents granted since 1972

FUTURE PROGRAMMES

(a) Strengthening CSIR manpower capabilities for marketing of its knowledgebase through structured training courses and exchange of visits and experts with similar successful organizations abroad

(b) Strengthening of existing mechanisms and identifiying new mechanisms and avenues for marketing of CSIR knowledgebase

(c) Devising overall and sectoral marketing strategies for CSIR

(d) Strengthening safe laboratory practices in CSIR laboratories

(e) Devising area/sectoral safety protocols for CSIR laboratories

(f) Creating databases on: (i) potential CSIR clients; (ii) potential technologies for development and, (iii) CSIR's manpower, capabilities and facilities

(g) Creating an awareness among CSIR personnel for securing IPR for their R&D output

(h) Extending international linkage for joint contract R&D and marketing of CSIR knowledgebase

TRAINING COURSES

The Division has organized in the recent past training courses on 'Technology Negotiations, Pricing and Contracting', 'Marketing of R&D and Services', 'Fire and Fire Fighting' and 'Intellectual Property'. It also organized an interactive meet of CSIR Directors on 'Implications & Impact of Economic Restructuring on R&D'.

PUBLICATIONS

The Division has brought out the following publications recently:

CSIR Forges Ahead— which highlights CSIR's significant achievements in major industrial sectors

CSIR: Scientific & Technological Capabilities — a reference document on R&D expertise, services and major S&T facilities in CSIR laboratories (being updated)

Compendium of New Technologies— a list of technologies recently developed and available off the shelf or under development

CSIR — a brochure giving in brief CSIR's input and output indicators, R&D areas of excellence, R&D facilities, world class breakthrough, etc.

A quarterly wall paper *'Safelab'* to create and promote awareness for safe laboratory practices on a wider basis among the staff of the CSIR.

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Telephone : 74083

CSIR Polytechnology Transfer Centre
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STD Code: 0612
Telephone: 50134

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Consultancy services, contract projects and testing/evaluation are undertaken by various laboratories in the areas/sectors mentioned against their names (figures in the parentheses refer to page numbers):

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